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Compendium of Abstracts of Papers on the Therapeutic Use of Radium.

With a Glossary of Terms in Radioactivity and Radiumtherapy

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PITTSBURGH, PA.

1920

FOREWORD

This Compendium of Abstracts has been prepared to give a summary of the results of Radiumtherapy as reported in the literature, and will, it is hoped, prove valuable as a reference work.

Papers that detail dosage, screening and results have been given first consideration.

It is the purpose to supplement these pages, from time to time, with an abstract of every paper obtainable that gives such data.

This Compendium is the first to detail in this way the work done with Radium, and these papers and supplements are made a part of the continuous service offered to our Customers.

RADIUM CHEMICAL COMPANY.

KEY TO INDEX

Note:

All malignant conditions are filed under the anatomical locations of the lesion on which they exist—"A.L."; dermatological conditions under skin—Non-malignant "S1"; Malignant, "S2"; other conditions are filed under name of organ or tissue in or on which lesion is located.

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Angioneuroedema	"S1"
Adenoma	"A.L."
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Bladder, Cancer of	"B"
Bladder, Papilloma of	"B"
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Z .... "Z"

Memoranda

Memoranda

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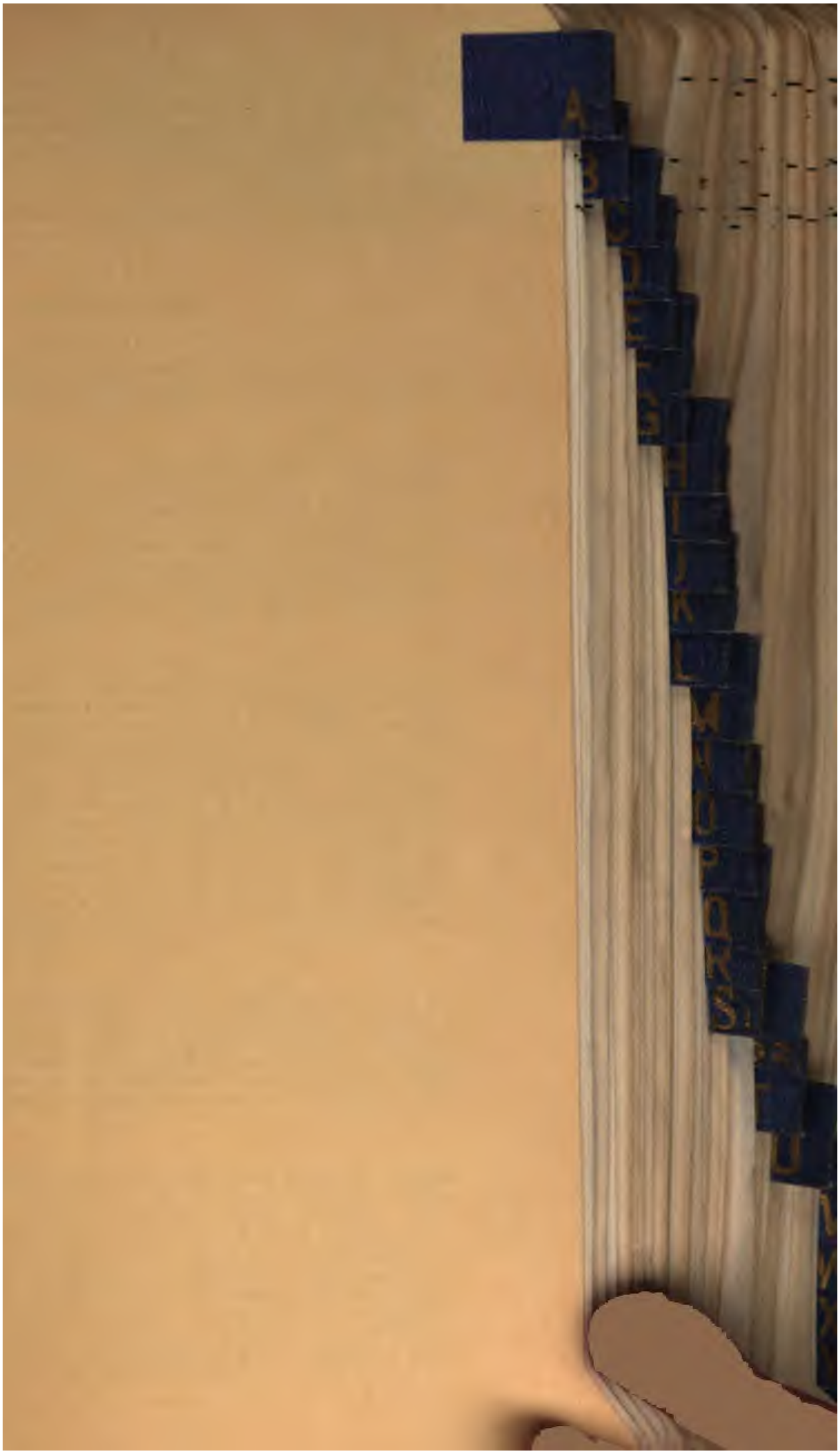
Memoranda


A
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Blaisdell, J. Harper. (Boston): **Squamous Cell Carcinoma of the Antrum.** (Report of a case treated with radium alone, that is free from recurrence twenty-two months after the last application.) *Boston Medical and Surgical Journal.* Nov. 10, 1921. p. 570.

CASE HISTORY.

"M. C., an optimistic dog fancier of 63, was referred to me by an oral surgeon, for treatment of a squamous cell carcinoma of the left antrum.

"Two years previously Mr. C. had had trouble with an upper left canine tooth, which was extracted. It was found then that a greater part of the root processes had been absorbed and that a previous dentist had left a pledget of cotton at the end of the root canal. Mr. C.'s mouth was in a very poor condition, with many decaying snags and considerable pyorrhea. The canine socket healed slowly and packing it with iodoform gauze was a part of the dressing procedure. Mr. C. discontinued his visits to the dentist before the healing was complete.

"No further trouble was experienced with this area until about 18 months later. A moderately painful alveolar abscess formed and Mr. C. was compelled again to seek the aid of a dentist. It was discovered shortly that a gauze dressing had been left in place in the socket from the time the patient had suddenly stopped his visits to the previous dentist some eighteen months before. The infected process in the meantime had worked its way through into the antrum. With the removal of the foreign body, a temporary period of improvement ensued, which was followed by steadily increasing swelling of the antrum, and a moderate amount of obstruction of the nose on the left side and constant discharge from it. The antrum was filled with a soft, pulpy material which, on removal of a portion of it for microscopic examination by Dr. W. H. Watters of the Homeopathic Hospital, proved to be squamous cell carcinoma.

"In connection with this coincidence of chronic tooth disease and a following cancer, it is interesting to note that nearly twenty-five years ago Wendell C. Phillips recorded in detail 16 cases, occurring in connection with a tooth or tooth socket, which were evidently squamous cell carcinoma which filled the antrum and then burst through the alveolar processes after the extraction of teeth for the relief of pain.

"The patient was first seen by me two years after the original tooth trouble and six months after the symptoms referable to the antrum had appeared. At this time the patient showed a badly swollen cheek. The skin was slightly reddened but otherwise unchanged. The mass was large enough to push the nose well over to one side. The shape of the palate was unaltered. As has been previously noted, there was obstruction and discharge from the affected nostril. Mr. C. complained principally of the extreme soreness of his teeth on that side of the upper jaw. This was so pronounced that he was unable to hold a pipe between his teeth, a matter of great personal hardship. No glands were palpable.

TREATMENT.

"November 20, 1919:—Under ether anesthesia an incision was made into the antrum through the canine fossa and the radium introduced. This consisted of 50 milligrams of radium element, screened with 0.5 millimetres of silver and 1.0 millimetres of brass. This was localized as nearly as possible in the center of the antrum, which was full of a soft pulpy tissue that bled freely. It was left in place for 24 hours, giving a dosage of 1,200-milligram hours.

"The immediate effect was excellent. At the end of three weeks a greater portion of the swelling had subsided. The pain and tooth tenderness had gone to such an extent that he was able to smoke a pipe again. The only reaction to the radium up to this time was a redness and a slight tenderness of the hard palate on the treated side and a small radium burn on the tongue. The hair on the cheek and the left half of his moustache was beginning to fall out.

"December 23, 1919:—On this date 50 milligrams of radium were introduced again by the same method and with the same screening and dosage. This gave a total of 2,400 milligram hours within a closed cavity in less than 5 weeks' time. At this time, exploration of the cavity of the antrum with a dull curette revealed little of the soft tissue that had been present so plentifully before.

"Three weeks after the second treatment a period of three months of extreme suffering began. At this time the opening into the antrum enlarged from necrosis, and drainage from the antrum was maintained. The cavity was flushed daily with a warm boric acid solution. The few remaining teeth on that side loosened and came out. The hard palate up to the median line and the alveolar processes gradually sloughed away, leaving borders of necrotic tissue flapping in the mouth. Although the necrotic process was continuous there was little odor and nothing of the characteristic fetor of carcinoma. Surgical carcinoma resulted in the advice to let things alone, but in another similar case I should insist on operative removal of the necrotic tissue which could be done with comparative ease.

RESULTS.

The constitutional effect upon the man himself was most striking. It is best described as a mental dulling and a most complete physical failing. Eating was, of course, most difficult, anyway, and his appetite disappeared completely. He had to be urged to take even eggs and milk. His memory failed and his mind became childish. The pain was so extreme as to demand morphine over a period of several weeks. This pain appeared over different areas on the head. He described the sensations as those of severe burning and swelling as if the top of his head was going to blow off. He would try to allay this with the

constant application of ice. He was confined to his bed for the last month of this three-month period. The eye on the involved side was not affected at any time. His weight fell from 180 to 130 lbs. A fatal termination seemed the only possible outcome to family and physician alike. On one Sunday forty-five relatives and friends came to bid him farewell and he remarked cheerfully months afterwards, "It seemed more like a wake than a visit of comfort to a sick man."

"On the following Tuesday morning a very large mass of sequestrum came away and Mr. C. tells that at the moment it was out he began to improve. He got out of bed for the first time for a month that same day, and his appetite came back immediately.

"The final result was complete removal of the antrum and its surrounding structures from the mouth to the orbit. The normal tissue healed readily and no further treatment or procedure has been necessary. Within a comparatively few weeks he was back at his work and he felt as vigorous as he had been all his life. His weight returned to 185. His speech is thick and difficult to understand and he has some trouble in eating, but for the present he declines any prosthetic device to help this condition. No recurrence has appeared in the twenty-two months that have elapsed since the second treatment on December 23, 1919."

Janeway, H. H.: **Treatment of Cancer, Particularly of the ague, Tonsil and Rectum by Buried Emanation.**—***American Journal Roentgenology***, February, 1920.

FILE UNDE

A

Antrum

Primary carcinoma of the antrum clinically cured by one treatment of unfiltered radium.

HISTORY.

Female, 59 years, No. 25687. Has been frequently ill with "sore throat." Eight weeks ago noticed a disagreeable sensation in her right eye and first became aware that the right cheek and eye were swollen. This swelling has gradually increased.

EXAMINATION.

The right cheek is swollen. The right eye is inflamed and bloodshot. Epiphora is present. Within the mouth the superior alveolar process on the right side is swollen, as if displaced downwards by distention of the antrum. In the bucco-gingival groove there protrudes a small ulcerated mass which is breaking through from the cavity of the antrum at this place.

Microscopical Examination. Epithelioma of the antrum.

TREATMENT.

July 29, 1918. Under local anesthesia the external carotid was ligated on both sides of the neck and the right antral cavity was opened by removing the superior alveolar process: 50 mc. unfiltered in glass tubes, placed in the center of the antrum and surrounded with packing: left in place 48 hours.

Following a period of radium inflammation and a lobar pneumonia, the patient made a good recovery, and on September 30, there was no evidence of the disease present.

New, G. B., Rochester, Minn.: Treatment of Malignant Tumors of
ie Antrum.—*Journal of American Medical Association,* May, 8, 1920.
-Vol. 74, No. 19; pp. 1296-1300.

FILE UN

A

Antrum,
Tumors of

Cautery and radium treatment of malignant tumors of the antrum have been followed by no operative mortality and no post operative chest complications. Two of the patients lost the eye on the side involved from the reaction from the cautery and radium, but in both cases the floor of the antrum was involved. Of the 18 cases with malignant tumors of the antrum who were treated, three are dead, two have extensive recurrences, over a period from eight to twenty-eight months. In seven of these ten cases there has been no recurrence after more than a year. In three cases, data regarding the present condition of the patient were not obtained. The ten patients who are well cannot yet be considered cured, but their cases should be classified as having been without recurrence for a period of months or years. The results of the treatment of malignant tumors of the antrum by the use of the cautery and radium seem to indicate that the operative mortality that usually accompanies the surgical treatment of these conditions have been improved markedly.

TECHNIQUE.

Tubes or needles have been used. Radium emanation is also used. Multiple needles are frequently inserted into the wall of the antrum, from the inside. Tubes of radium salts or of the emanation are introduced into the antrum at the point at which they seem most needed either at the time of the operation or from 10 days to two weeks later, after some of the slough has cleaned up.

Patients are kept under observation. They return every month or six weeks so that if any recurrence takes place they may have immediate care, since this is very essential in order to control early recurrences. Following the treatment most of the inside of the antrum comes away as a sequestrum in two months time, and large openings are left in the palate, but they may be readily closed by the prosthetic appliances.

DOSAGE.

Depends upon type of malignancy, its duration and extent. "We use 100 or 200 mg. for from 12 to 24 hours inside the antrum, besides giving radium treatment outside the cheek with screening and distance." The radium treatment may be repeated in three weeks, if indicated.

A

[illegible] Malignant Tumors [illegible]

[illegible] the antrum [illegible]

[illegible] Two of the [illegible]

[illegible] patient [illegible]

[illegible] tumors of the antrum by [illegible]

[illegible]

[illegible]

Pinch, A. E. Hayward, Medical Superintendent Radium Institute, London: A Report of Work Carried Out at the Radium Institute, London.—*Annual Report for* 1919. *Radium*, September, 1919.

TECHNIC.

The daily administration of 250 cc. of radium emanation solution of a strength not less than 1.5 millicuries per litre, continues to give excellent results in selected cases of this disease. The patients who are most favorably influenced are those in whom fibrous, as distinct from osseous, changes are predominant, and in which the condition is infective, rather than traumatic in origin.

Cases of long standing with bony ankylosis, osteophytic formation, or ulceration of interaricular cartilages derive but little benefit beyond possible relief of pain.

FILE IND

A

Arthritis Deformans

Pinch, A. E. Hayward, Medical Superintendent Radium Institute, London: *A Report of Work Carried Out at the Radium Institute, London.*—*Annual Report for 1919. Radium,* September, 1919.

TECHNIC.

The daily administration of 250 cc. of radium emanation solution of a strength not less than 1.5 millicuries per litre, continues to give excellent results in selected cases of this disease. The patients who are most favorably influenced are those in whom fibrous, as distinct from osseous, changes are predominant, and in which the condition is infective, rather than traumatic in origin.

Cases of long standing with bony ankylosis, osteophytic formation, or ulceration of interarticular cartilages derive but little benefit beyond possible relief of pain.

Smith, George Gilbert, M.D., F.A.C.S. (Boston): "The Management of Cancer of the Bladder." *Boston Medical and Surgical Journal.*
Vol. 187, No. 3, July 20, 1922.

FILE UN
B
Bladder, Cancer

"In this paper I have endeavored to show that all tumors of the bladder (barring some varieties, as fibromata) are potentially, if not actually, malignant; that early diagnosis by means of the cystoscope is the first requisite for successful treatment. Every misbehaving bladder should be considered guilty until it is proved innocent."

"The methods of treatment consist of fulguration, radiation by means of implantation of radium, excision of the tumor, total cystectomy, or, in hopeless cases, cauterization and permanent suprapubic drainage. The particular measure or combination of measures selected depends upon the type of tumor which is disclosed by careful study of the case. The results of surgery in cancer of the bladder are now far from satisfactory; improvement is to be expected only through earlier diagnosis, followed by more radical treatment in some cases, in others by the intelligent use of radium."

TECHNIC.

"From our experience at the Huntington Hospital we have come to the opinion which I think is now held by most genito-urinary surgeons, that it is next to useless to treat infiltrating cancer of the bladder by radium introduced into the bladder and applied, more or less accurately, to the growth. The cancer, to be destroyed, must be sloughed out, and the best way to accomplish this is by means of radium implanted directly into the tumor. The means of radiation may consist of needles containing radium salt, in which case a number of small needles, of 5 mg. each, are preferable to fewer large ones; or it may consist of little glass tubes containing radium emanation. If the needles are used, they should be inserted about one cm. apart and pulled out by means of thread after 24 or 36 or even 48 hours, according to the amount of radiation desired. If the emanation tubes, or "seeds," are used, they are abandoned in the tissues. In either case the effect is substantially the same. Close to the needle or tube the tissues become completely necrotic; further away there is a zone in which the cancer cells are killed but not sloughed out. Beyond that is a zone in which infiltration with leucocytes and fibroblasts takes place, forming a barrier of dense connective tissue. The center of the growth, where the rays from the tubes cross each other in all directions, sloughs away. Around the periphery there is found a barrier of connective tissue which prevents the spread of cancer cells by way of lymphatics. The process of destruction and repair takes from two to six months, depending upon the condition of the patient and the extent of the reaction. Infection may supervene, and sometimes causes the death of the patient.

"The application of this method to bladder cancer is limited to those cases in which the area to be radiated does not exceed 3 or 4 cm. in diameter; if larger growths are radiated, the extensive necrosis is likely to prove more than the patient can stand."

Ewing, J., M.D.: "A Review and Classification of Bone Sarcoma."
Abst. *Surgery, Gynecology, Obstetrics.* *Arch. Surg.* 1922, iv., 485.
September, 1922.

SHEET NO. 1

FILE UND

B

Bone Sarcoma

CLASSIFICATION OF BONE TUMORS

Osteoma: Spongy, ivory.

Chondroma: Pure chondroma, chondromyxoma, myxoma: capsular, periosteal, central.

Angioma: Cavernous.

Endothelioma: Angio-endothelioma, diffuse: solitary, multiple.

Benign central giant-cell tumor, xanthosarcoma, myxosarcoma (benign).

Osteogenic sarcoma: Periosteal, extraperiosteal, solid medullary and subperiosteal, telangiectatic, sclerosing.

Myeloma: Plasma cell, lymphocytic, myelocytic, erythroblastic.

Only the cellular forms in this table are discussed in this article.

ENDOTHELIOMA

"Endothelioma of bone has usually been called round-cell sarcoma or myeloma, but sufficient is now known regarding this form of tumor to establish it as a distinct type. Ten cases have been seen by the author in the past year. There are three anatomical forms: (1) multiple endothelioma; (2) solitary angio-endothelioma, (3) diffuse endothelioma."

PROGNOSIS AND TREATMENT OF BONE TUMORS

"The prognosis and treatment of bone tumors should be revised in the light of our present knowledge regarding roentgen-ray and radium treatment and the nature of the growths. The suspicion of sarcoma should not be taken as a signal for operation but should call for thorough consideration of the clinical history, the roentgen-ray findings, and the results of therapeutic tests with radium and the roentgen ray. The goal in a great many cases should be non-operative treatment. Myelomata and endotheliomata yield rapidly to the roentgen ray and radium. Osteogenetic sarcoma and chondro-sarcoma are not materially affected by radium. The more experienced the pathologist, the less prognostic importance he attaches to the microscopic findings and the more to the clinical manifestations. Tumors in the same group vary in malignancy and blanket rules do not apply.

"Giant-cell tumors have usually been treated by curettage, but this method sometimes results in osteomyelitis or septicaemia, and there is a possibility of producing metastases by liberating cells into the blood stream. These disastrous results may be avoided by the use of radium. Radium should be applied externally through the intact skin. It should never be inserted into a curettage cavity as the radiation makes the tissue more susceptible to infection.

"Myeloma has an unfavorable prognosis under any form of treatment, but roentgen-ray and radium therapy are the methods of choice.

"There seem to be no reports of a surgical cure of angio-endothelioma or of its treatment by physical agents. Because of its multiple origin and early metastasis, the prognosis is unfavorable. The diffuse endotheliomata, however, regress quite rapidly under radiation. The osteogenetic sarcomata vary widely in their response to treatment. There are five grades:

1. Encapsulated extraperiosteal fibrosarcoma: fibrous, cartilaginous, or osteoid stroma in excess of cells; prognosis fair.

2. Sclerosing medullary and periosteal sarcoma: course slow; metastases appear very late.

3. Cellular spindle-cell periosteal sarcoma; stroma scanty or absent; some cures by surgery and other methods.

4. Solid cellular central and subperiosteal sarcoma: some surgical cures of early cases.

5. Very vascular cellular telangiectatic sarcoma: some surgical cures of early cases."

"After seven years' trial of radiation in the treatment of osteogenetic sarcoma, the author offers the following conclusions:

1. The histologic changes and the clinical course show that it is possible to give an effective dosage of the roentgen rays or radium to all parts of many osteogenetic sarcomata when the tumors are accessible from all sides.

2. The growth of the cells may be retarded so that they produce calcific material, dense hyalin stroma, or bone.

3. Cellular tumors without much stroma may disappear.

4. Tumors with much intercellular material cannot be made to disappear but may be sclerosed or ossified so that growth stops.

5. The majority of true osteogenetic sarcomata, although retarded in growth, usually prove fatal through metastases. The possibility of a cure by amputation acts against conservative treatment, but as in certain cases life has been sustained for some time by heavy radiation it is possible that this form of treatment distinctly postpones metastasis.

6. By the proper selection of cases and judicious supplementary surgery, the roentgen ray and radium may be made more efficient in the treatment of osteogenetic sarcoma."

Pancoast, Henry K., M.D., University of Penna. "Treatment of Brain Tumors by Radiation." American Journal of Roentgenology," an., 1922, p. 42.

SHEET NO. 1

FILE UNI

B

Brain. Tumo

Brain tumors are as a rule comparatively slow of growth and do not tend to metastasize and are therefore peculiarly adapted to treatment by radiation.

If the growth is localized and accessible, it may be exposed and left intact, or it may be partially or completely removed and subsequently treated by radiation or by direct implantation of radium, or by cross-firing through the skull. Cross-firing holds possibilities in even inaccessible tumors or in those not localizable.

The dangers are comprised under (a) infection caused by radium needles or implanted tumors or infection dependent upon leaving the wound open for the removal of these; (b) the effect upon the flap and upon subsequent healing as a result of external cross-fire; this cross-fire may be postponed until healing is under way, however, and since the dosage is a safe skin dosage, necrosis of the flap will then be a remote possibility; (c) the effect of radium radiation directly upon the normal brain tissue.

The last possibility demands careful consideration. The technic must be based upon the known ability of the normal brain tissues to withstand definite amounts of radiation by implantation or by external cross-fire.

Animal experimentation was resorted to to establish these facts. This experimentation was carried out upon dogs at the University of Pennsylvania and the following facts have been thereby established: A dose of nine hundred milligram hours with well filtered radium on the surface of the brain is practically safe, but no dose should exceed eleven hundred and fifty to fourteen hundred milligram hours and might better be well below fourteen hundred. The safest dosage for implanted tumors is much smaller than the safe surface dose. When actual destruction of normal brain tissue is apt to result, the therapeutic dose from implantation must be comparatively small. The well filtered dose may be higher than the unfiltered and tumors act as a filter in protecting the normal tissue.

Because of the great difference in size between the human and canine head—and because of the comparative safety of the procedure with humans—no animal experimentation was made with external cross-fire radiation. Nausea and possible collapse are possibilities to be kept in mind in cross-fire treatment and slow procedure is therefore wise.

The technic employed in the treatment of brain tumors is based upon the following factors:

(1) Safe, yet sufficient dosage (based upon clinical and experimental experience).

(2) Implantation contraindicated when removal has taken place unless a large cavity persists which will permit of the radium being packed in the center.

Pancoast, Henry K., M.D., University of Penna. "Treatment of ain Tumors by Radiation." American Journal of Roentgenology," n., 1922, p. 42.

SHEET NO. 2

FILE UNI

B

Brain. Tumo

(3) If the growth has been partially removed, or not removed at all, then the implantation dose depends upon the size of the tumor and its nature—with due regard to the normal brain tissue the destruction of which must be distinctly limited in the brain.

(4) Knowledge of the pathological nature of the tumor is essential.

(5) Dosage for brain tumor is approximately the same as for tumor of the same size and nature elsewhere in the body, providing it is not one peculiar to the brain.

(6) Implantation must usually be supplemented by external cross-fire.

(7) Cross-fire radiation can be repeated with slightly reduced dosage over each area as soon as the skin reaction has subsided.

Cases are grouped as follows: (a) tumors accessible to the surgeon and presumably completely removed; (b) tumors accessible to the surgeon and partially removed; (c) tumors accessible but not removed; (d) tumors not localized or not found at operation; (e) pituitary growths. A general technic is given for each specific group named.

Thirty-two cases have been treated and four considered to have the most important bearing upon this subject are discussed at some length. The writer regards his experience in radiation therapy of brain tumor as very encouraging and full of promise.

Neill, William Jr., Baltimore, Md.: Radium in the Treatment of arcoma and Carcinoma of the Bone.—*American Journal of Surgery*, eb. 1921, pp. 32-33.

FILE UND
B
Bone Tumors

For the past several years, but especially during the last year, we have tested out the efficacy of radium in sundry sarcomas of the bone, and in consequence, I am glad to say, we can now hold out a little hope, and certainly a greater one than when operation alone is resorted to. We have found that radium will sometimes destroy the disease and allow a new formation of healthy callus.

The number of cases under observation and treatment is too small to cite percentages, but they are at least suggestive and lead us to hope for greater success in the near future as we continue to develop a more effective technique.

TREATMENT

Three methods of treatment with radium which we have followed are: First, implantation or burying of radium emanation directly into the disease (from 1 to 3 millicuries) contained in minute glass capillary tubes which are left permanently embedded. Second, massive treatments from the surface at a variable distance of from one to four inches with from one to four grams of radium. Third, laying bare the diseased tissue by operation and inserting, under inspection, a large amount of radium into the tumor, while the patient is under the anesthesia. Only with large amounts of radium can this last method be followed. The first method seems to be the most destructive of the local disease and the most effective. Like the second, it is painless, it causes no severe reaction, and does not necessitate the patient's detention in the hospital as in the open wound plan. Sometimes the three methods of treatment have been combined.

DOSAGE.

The approximate dosage for the needles, points or specules as they are called, containing emanation, is 2 millicuries of emanation for each 4 cubic centimeters of disease for implantation; 5 gram hours at 2 inches distance for each 3 square inches of surface, when treated from the exterior; one half gram hour direct treatment when placed under inspection in the center of the disease.

RESULTS.

In almost every case we are fortunate enough to secure complete or partial relief of pain; this is the most striking result, and we feel that this alone well repays all our efforts. There is also a marked decrease in the swelling of the soft parts with increased function, a general improvement in health, and by x-ray examination, a redisposition of new bone. This change takes place in an interval of from two to five weeks.

Cites three case histories.

Pfahler, Geo. E.: The Treatment of Recurrences and Metastases from Carcinoma of the Breast by means of Radium and Roentgen Rays.—***American Journal of Roentgenology*, July, 1920, pp. 328-332.**

SHEET NO. 1

FILE UNI

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Breast Carcinoma

"It has been my observation from the use of these two agents that radium will produce a greater local effect in proportion to the amount of surface irritation as compared with the roentgen rays. I have also noticed that radium will produce a more pronounced effect upon localized nodules than the roentgen rays, but that the roentgen rays are more useful for their general and wider distribution and for the treatment of deeper lesions, which can be reached by skillful cross-firing effect. Therefore, in the treatment of localized nodules in line with the incision, or of those localized in the axilla or in the supraclavicular region, I make use of radium because the radium can be brought into immediate contact with these nodules, and they can be made to soften and disappear. There is another distinct advantage in the treatment of the nodules located in the axilla by means of radium, because one can place it deep into the axilla much more conveniently than the roentgen rays can be applied. I have seen nodules the size of my thumb disappear within a month from the beginning of the application of radium. The radium must be applied with skill and due consideration must be given to the amount of radium, the amount of filtration, the distance from the parts to be affected, and the time of treatment. I believe it has not yet been proven whether massive dose treatment by radium or fractional doses will prove the most desirable, but it is the general impression that the massive dose treatment would produce the most satisfactory results and can be applied with more skill. A report on any particular case in which radium has been applied and in which only the amount of radium is mentioned, or even the duration of application, means little or nothing, for we know very well that the effect varies with the square of the distance at which it is applied, and that the effect is modified very much by the amount of filtration. Variations in the application must be made according to the conditions in any given case and these patients can no more be treated by rule than pneumonia patients or appendicitis can be treated by any fixed operation."

TECHNIC.

"In a very general plan of treatment, which can at no time be followed blindly, for the treatment of these nodules I would make use of radium filtered through ½ mm of silver, 1 mm of brass, 3 mm of pure rubber, and about 2 cm of gauze or felt. The duration of the application will depend upon the amount and concentration of the radium used. In general, 100 mg. distributed over an area 4 x 8 cm so as to produce as nearly as possible homogeneous rays can be left in place twenty-four hours. Fifty milligrams can be left in place for twenty-four hours in the supraclavicular region. Fifty milligrams divided into two portions can be left in place in the axilla for twenty-four hours with like filtration. * * * Radium and Roentgen rays should never be applied through the same area of skin within a period of four weeks providing either has been used to the degree of an erythema dose."

RADIUM EFFECTS.

"Within a week there will usually be some redness of the skin and within two weeks there is often desquamation of the surface of the skin. This always heals easily and at the end of two weeks there

is usually a distinct reduction in the size of the nodule. If the nodules have appeared quickly, and are of short duration they disappear usually more rapidly. At the end of a month the redness of the skin will usually have disappeared, and if the nodule has not disappeared the treatment should be repeated. If they have disappeared I believe it is practical to wait two weeks longer and then repeat the treatment with the idea of getting rid of all the local disease; or it may be well to give half a dose at the end of a month and another half dose two weeks later. I am not sure which of these procedures is best. In all instances, these recurrent nodules mean almost certainly that there are extensions of the disease elsewhere, and these extensions may be in any direction; but are generally towards the mediastinum. Therefore the greatest attention must be given to this distribution by means of the roentgen rays. In certain cases in which the nodules do not disappear completely or satisfactorily as a result of the surface application of radium as above described, a greater success can be obtained by means of the introduction of radium needles direct into the nodules and around about the nodules."

CONCLUSIONS.

"Radium is our most useful agent in the treatment of palpable recurrent or metastatic nodules from carcinoma of the breast."

Janeway, Henry H.: The Use of Buried Emanation in the Treatment of Malignant Tumors.—*American Journal of Roentgenology,* July, 1920; pp. 825-827.

FILE UN

B

Cancer of Breast

Indications for the use of buried emanation in the breast.

Buried emanation may be used in non-ulcerated carcinomas of the breast when it is desired to avoid surgical removal.

(See Janeway's Chart of Dosage at the Memorial Hospital, filed under D.—Dosage Emanations.)

Quigley, D. T. (Omaha): Discussing Use of Radium in Cases of 'aget's Disease. *Amer. Jour. of Roent.* Nov. 1921. p. 671.

FILE UNDI

B

Paget's Disease

"I wish to report that during the last seven years I have been engaged in radium treatment; in the first three years I encountered 6 cases of Paget's Disease * * * * Today four of these women are still living, 66% cures. They have had no treatment but radium on the Paget nipple. They were all typical cases of Paget's Disease with the erosion and the punched out condition, but no involvement of the glands.

DOSAGE.

"We used 50 mgm. directly on the ulcer screened only by ½ mm. of silver and ½ mm. of rubber. This is a particularly small dose.

"The technique of these breast cases in general is interesting. I believe they should be submitted to operation. I still operate on Paget's disease when the women will submit.

Smith, G. G. (Boston): **Radium in Cancer of the Bladder.**
urg. Gynecology & Obstetrics. Nov. 1921. p. 570. *Abst. in J. A. M.*
. Dec. 10, 1921.

FILE UNDE

B

Bladder, Cancer of

"From Smith's study of cases it would appear that 400 millicurie hours given with a screening of 0.5 mm. or 1.0 mm. silver is a dosage which may be used in the treatment of bladder cancer without any very marked reaction. Large doses, in bladders which are subject to the alternate diastole and systole of urination, are likely to set up a reaction which is very painful. If the bladder is drained suprapubically, greater doses may be used, and if the urine is entirely excluded from the bladder, doses of 1,000 millicurie hours do not cause discomfort. The duration of a reaction of moderate severity is from four to six weeks. Repeating the treatment in less than six weeks gives, therefore, cumulative effect. If, however, no reaction has developed in three weeks after the first treatment, it is proper to go ahead with the second treatment."

Geraghty, J. T., Baltimore: Value of Radium in the Treatment f Bladder Tumors.—*Southern Medical Journal*, July, 1920. Vol. XIII, o. 7.

During the past four and a half years radium has been employed extensively in our clinic in the treatment of the various types of bladder tumor and its effect on the different types of tumor studied. During this period of time there have been observed in our clinic 170 cases of bladder tumor. Seventy-nine of these were classified as papilloma, either benign or malignant, or early papillary carcinoma in which there was no invasion of the bladder wall. There were 90 cases of infiltrating papillary carcinoma in which more or less extensive infiltration of the bladder wall was present and 1 case of basal-celled carcinoma.

It has been our experience that all of the papillomata, either benign or malignant, together with the early papillary carcinomata, usually respond to vigorous radiation. The more malignant the tumor the greater the amount of radiation necessary to effect its disappearance. Where extensive infiltration of the bladder was present, the results with our present methods of radiation have so far been rather discouraging and in no case of extensive carcinoma have we succeeded in effecting a complete disappearance of the tumor. While the results in the treatment by radium of the extensively infiltrating tumors have been unsatisfactory, most brilliant results have been obtained in the less infiltrating types of early papillary carcinoma ofttimes where the tumors were multiple and where successful resection could not be accomplished.

While the majority of malignant papillomata respond to fulguration alone, there are certain cases which are most resistant to this method of treatment and in some which it is impossible to destroy by this means. Early in our experience with radium it was found that if radiation were employed, the tumor was quickly transformed from one most resistant to fulguration to one which responded as readily as to the most benign type. It has been our experience that the early papillary carcinomata do not respond to fulguration and are frequently stimulated by the cauterization. This type of tumor which in the past required radical operative procedures with ultimate results usually bad will respond to radiation if the infiltration of the bladder wall is not too extensive. It is our routine at present to radiate all papillary tumors except those which are definitely of the benign type, in which fulguration rapidly effects a cure.

TECHNIC.

The treatment of all these cases has been carried out with 103 to 210 mg. of radium element. In most cases the radium has been contained in a capsule of platinum or gold of sufficient thickness to filter out most of the irritating beta rays. Young has devised a cystascope which carries the radium in the beak of the instrument. By this it is possible under direct vision to place accurately the radium on the tumor. After the radium has been brought in contact with the tumor, the cystascope is held in a fixed position by means of a mechanical arm attached to the cystascopic table. It is advisable to have the bladder moderately distended with water during the application, thus protecting the normal portions of the bladder from any possible irritating action of the radium. This is an important measure, as it enables one to give intensive treatment to the tumor without subjecting

the normal bladder wall to the danger of a radium burn. In a few of our early cases in which this precaution was not taken ulcerations were observed. It is interesting to note that ulcerations were not particularly painful and usually healed in six months without any special treatment. The radiations are usually given for one hour, the applications being carried out from one to three times weekly depending upon the size and character of the tumor and the reaction of the patient.

CONCLUSIONS.

"While benign and malignant papilloma and the early papillary carcinoma disappear under the influence of radium, the infiltrating types have proven very resistent to this agent. It is our procedure, therefore, when the infiltrating character of the growth has been determined, and when the tumor is sufficiently localized to permit of complete removal, to carry out a radical resection. Following the removal of an infiltrating papillary carcinoma, cystascopy should be done at an early date as the not infrequent recurrences will yield promptly in many instances to radium, notwithstanding the resistance of the primary tumor. It is of interest to note that the use of radium has not diminished the tendency of bladder tumors to recur, recurrences being observed in about 30 per cent. of the cases treated. The recurrence, however, responds to radiation in most instances, although in three cases it did not yield. Radium has certainly proved to be a valuable aid in the treatment of bladder tumors, and while the results obtained in the infiltrating types are far from satisfactory, improved technic whereby more intensive radiation may be safely accomplished may offer a more encouraging outlook in the future handling of these cases."

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Jeck, H. S.: Apparent Cure of Carcinoma of the Bladder.—
International Journal of Surgery, 1919; XXXII, p. 240.

FILE UNDE
B
Cancer of
Bladder

Reports clinical history of a married woman 55 years of age complaining of haematuria which had continued for four months.

TREATMENT.

Two tubes of radium emanations of 31 and 37 millicuries were introduced into the bladder by the way of the urethra and left in place for seven hours (476 millicurie hours). The radium was screened with silver ½ millimeter in thickness. About a week later there was a slight increase in frequency of urination which probably was due to radium burn. No change in the growth was shown a month later. Forty millicuries in a tube was then introduced into the bladder, where it remained seven hours. Two months later, two tubes of 70 millicuries each for five hours, were applied to site of the original growth. The haematuria completely ceased and has not reappeared.

Barringer, Benj. S., New York: Carcinoma of the Bladder.—*Journal of American Medical Association,* November 11, 1919.

FILE UNDI

B

Cancer of Bladder

Reports 9 cases of carcinoma of bladder treated with Radium.

TECHNIC.

The method of treatment in bladder cases consists in the introduction through the direct cystoscope of 100 to 200 millicuries of radium screened with 0.6 mm. of silver and 1.5 mm. of rubber and enclosed in a capsule an inch long and an eight of an inch in diameter. To the end of the capsule a long, double linen thread was attached and allowed to pass out of the urethra to be used for the removal of the radium. The patient was encouraged to hold his urine during the treatment to aid in screening the bladder. If the carcinoma is lateral the patient should lie on the affected side.

The exposure lasted up to eight hours. The application was not repeated until all effects of the preceding one had disappeared.

Lequeux, P. and Chome, E.: Bactericidal Action of Radium.— *Archives Mens d' Obstetrique et de Gynecologie,* Paris, December, 1919, 8, No. 12; Abstracted in *Journal of American Medical Association,* April 10, 1920.

FILE UN

B

Bacteria

Lequeux and Chomè were unable to detect any destructive influence from the radium rays on the typhoid and colon group. The rays arrest the progress of the culture, check production of pigment and cause agglutination but no bactericidal action was evident except for the gonococcus, and, perhaps also for the streptococcus. The action of radium on bacteria in the blood stream was not demonstrated, but certain facts observed are certainly significant, namely, that one mouse thus treated survived experimental pneumococcemia; rabbits developed milder sepsis after inoculation with staphylococci and a few other similar experiences.

Pinch, A. E. Hayward, London: A Report of the Work Carried Out at the Radium Institute, London.—*Annual Report for* **1918.** *Radium*, **August, 1919.**

FILE UND

B

Bladder Carcinoma

TECHNIC.

Whenever practicable, this condition should be treated both by the introduction of radium into the bladder and by screened applicators placed externally above the pubes, on the perinæum, and in the vagina or rectum, as by these means a very effective cross-fire irradiation can be obtained.

With female patients the intra-vesical treatment presents no difficulty, the urethra being short, straight and readily dilated. In male subjects, however, the presence of an urethral stricture or much enlarged prostate often renders the introduction of radium into the bladder difficult or impossible. If the presence of a malignant growth of the bladder has been rendered evident by supra-pubic cystotomy, the intra-vesical treatment should be carried out through the suprapubic opening before it has closed.

*DOSAGE.

A tube of 50 mg. activity, screened with 1 mm. of silver, should be employed, and a total exposure not exceeding twelve hours in duration, spread over three or four days, given. For the external treatment, the use of apparatus containing in all 300 to 500 mg. screened with 2 mm. of lead, with a total exposure of from 24 to 36 is indicated. In not a few instances, treatment on these lines has been followed by a rapid disappearance of the hæmaturia, and all other troublesome symptoms, accompanied by shrinking and fibrosis of the tumor, and an “apparent cure’ of the disease.

*These dosages being expressed in terms of Radium Bromide, must be divided by 2 to express the dosage in terms of radium element.

New, G. B., M. D.: The Value of Radium in the Treatment of Neoplasms of the Nose, Throat and Mouth.—*Journal of American Medical Association*, Vol. LXXI., 1918. *Radium*, October, 1919.

FILE U

B

Nose

SEE JAWS.

Neill, William, Jr., M. D. (Baltimore): · **Radium in Treatment**
' **New Growths of the Male Bladder.** *Journal of the A. M. A.*,
ec. 16, 1922, 2061-2063.

SHEET NO. 1

FILE UND
B

New Growths
the Male Bladd

TECHNIQUE

For many years in this clinic, the open air cystoscopic technic has been in daily use. It is convenient and rapid, affords direct information as to the bladder surface, and allows of the widest range of manipulative procedures within the entire bladder. As early as 1893, Dr. Kelly had made a speculum 18 cm. long and 8 mm. in diameter, similar to the now well known Kelly female cystoscope, for investigation within the male bladder; but he was unable to secure an opportunity for a practical demonstration until Nov. 20, 1897.

Dr. Kelly himself has always used the knee-chest posture as the one giving the best dilatation of the bladder and most convenient to him through long practice. While painless and best in females, this posture is not convenient in males; on the other hand, an exaggerated Trendelenburg posture with the head of the table lowered to an angle of 60 degrees gives an effectual air dilatation in all but contracted irritated bladders, and very fat subjects; in the latter groups, a general anesthetic will usually secure the desired result.

I myself work with two instruments; the Greenberg cystourethroscope and a Kelly cystoscope 16 cm. long and 10 mm. in outside diameter. This size Kelly cystoscope is easy to introduce in the average man. It is convenient to have a series beginning with a diameter of 7.5 mm.

Passing to the subject in hand, the treatment of bladder tumors through a cystoscope should be limited to cases in which all parts of the growth can be clearly seen and outlined; if it is large and infiltrating, provided the general condition of the patient permits, and there is no evidence of metastases, the treatment should preferably be by suprapubic exposure. However, when an operation is contraindicated, such patients can be helped and should be treated by the cystoscopic method.

I have used radium emanation with two types of applicators. The radium emanation for surface treatment is contained within a tiny glass bulb, 3 mm. in diameter, encased in a small brass capsule measuring 1 by 0.5 cm. and 1 mm. thick, which in turn is placed in a second brass capsule, 3 by 1 cm. and of the same thickness, and screwed to the handle. The points for implantation, bare tubes or spicules, as they are called contain the emanation in tiny glass capillary tubes, 2 mm. long and 0.5 mm. in diameter. These are placed in the end of the hollow needle on the point of the introducing instrument, and after it is implanted into the growth, the tube containing the radium is pushed out from the needle into the tissues by means of a stylet.

In 1920, Dr. Robert M. Lewis (at that time an associate at this hospital), devised an excellent instrument for implanting bare emanation tubes into the nasopharynx and larynx, as well as for use in the female bladder through the Kelly aeroscope; the instrument I use is my modification of his original one. Care must be taken to insure an accurate estimate of the amount of emanation in each tube used, and it is imperative that each individual tube should be an active one before implantation.

Neill, William, Jr., M. D. (Baltimore): Radium in Treatment New Growths of the Male Bladder. ***Journal of the A. M. A.***, **ec. 16, 1922, 2061-2063.**

SHEET NO. 2

FILE UNDI

B

New Growths
the Male Bladd

For surface treatment, 100 milligram hours' radiation is the maximum dosage for each square centimeter of the area of disease. In using an applicator containing 1,000 millicuries, it is therefore necessary only to hold the applicator six minutes on each area to obtain the equivalent amount of radiation. In this way, a tumor with a surface of 9 sq. cm. would receive the maximum dosage in a total of fifty four minutes. By using a stronger applicator, the actual time of exposure can be further reduced. The entire treatment is finished in one or two exposures, extending over a period of from two to three days. This amount of surface irradiation should not be repeated within six weeks.

For implantation treatment, the small glass emanation points are implanted directly into the growth. We employ 0.5 millicurie of radium emanation to destroy 1 c.c. of tumor. In this way, with a number of introducing instruments prepared beforehand, we can quickly and accurately introduce from ten to fifteen of the points throughout all parts of the growth, the entire time consumed being about five minutes. The points are left permanently embedded in the tissue to decay, giving off their maximum activity by the end of seven days, but continuing slightly active for twenty-eight days; the action is local and caustic. An intensive treatment such as this should not be repeated until a period of two months has elapsed. We have found that a better result can be expected by using multiple points containing a fraction of a millicurie, rather than by implanting fewer stronger points. A number of these points escape with bits of the tumor and are discharged with the urine.

Bugbee, Henry G., M. D., F. A. C. S. (New York): Some Recent dvances in Urological Surgery. ***New York Medical Journal and edical Record*****, Nov. 1, 1922, No. 9, pages 491, 492.**

SHEET No. 1

FILE UNDE
B

Urological
Surgery

CANCER OF PROSTATE AND BLADDER TECHNIQUE.

Cases of prostatic cancer require the most careful study. As stated, symptoms are often delayed until, with the first manifestation of urinary disturbance, malignancy is found far advanced. The first phase of the study should be to determine, if possible, the presence of metastasis. A complete study of the body functions and of the bones with x-rays is necessary. If metastasis is present, little can be done other than to relieve urinary retention by the partial removal of the prostate, by limited use of radium or by permanent suprapubic drainage.

If the cancer is limited to the prostate, removal may be indicated in some cases, while in others relief and possibly a cure will be obtained by the introduction of radium into the prostate by means of needles passed into the gland through a suprapubic cystotomy wound, others through the perineum, and by means of surface application of radium to the rectal and urethral aspects of the prostate.

Radium was taken up as our agent of destruction of bladder growths, applied first through the cystoscope to the surface of the growth, and latterly introduced into the tumor through a suprapubic opening. When applied to the surface of the growth by cystoscopic methods, there was always a question of the nature and extent of the growth, discomfort and irritation accompanying or following the application and inability to reach the deeper structure.

It is now our custom in a papillomatous growth to attempt fulguration. If the growth does not respond at once, it is considered malignant and further effort along this line may stimulate the growth or valuable time lost to other methods which might bring about a cure.

The bladder is opened and if possible, as with cancer in any other part of the body, the growth removed, radium needles being inserted into the bladder wall about the line of suture. In all the bladders I have opened for growth during the past two years, the tumor has proved to be in whole or part malignant. While it is possible in many cases to resect a bladder with an apparently wide margin of healthy tissue, we found in one case cancer cells extending along the muscle bundles to the edge of the line of resection with no superficial evidence of growth. The fortification of the line of resection in the immediate location of the growth with radium may help to avoid recurrence. It causes a localized sloughing which lasts three or four months, has given no untoward results and there have as yet been no recurrence in six cases treated. In two cases of localized infiltrating cancer where a resection could have been done, the growth was not excised but entirely destroyed by the repeated introduction of radium needles through a suprapubic sinus. Extensive, infiltrating carcinoma was destroyed in this same manner in six cases where resection was impossible; four of the patients are free of growth and two subsequently died of general metastasis. Two recent cases of extensive infiltrating growth show marked retrogression of the growth; these cases give us encouragement.

Bugbee, Henry G., M. D., F. A. C. S. (New York): Some Recent dvances in Urological Surgery. ***New York Medical Journal and edical Record,*** **Nov. 1, 1922, No. 9, pages 491, 492.**

SHEET No. 2

Obviously little can or should be done for an extensive infiltrating cancer of the bladder with metastasis other than to try to make the patient more comfortable, possible by permanent drainage.

Radium is an important accessory to surgery but must be used with caution. Cancer tissue must be destroyed slowly, for toxemia always results and too rapid or strenuous application will destroy the patient more rapidly than the growth. By proper study of individual cases, before instituting any line of treatment, especially as regards the presence of metastasis, applying fulguration surgery, radium or a combination of methods, carefully watching the patient after operation that recurrences, which, when detected early, are often easily destroyed by fulguration or radium—far better results are going to be obtained in the future in this once almost universally fatal class of cases.

Johnston, Zoe Allison, M. D. (Pittsburgh): Treatment of Carci-
na of the Breast by Radiation. ***The Pennsylvania Journal of***
***ntgenology*, October, 1922, No. 4, 1-4.**

SHEET NO. 1

FILE UND

B

Carcinoma of the Breast

CLASSIFICATION.

We classify malignancy of the breast under three classes, operable, borderline and inoperable or recurrent, and advise treatment accordingly.

In early operable cases of cancer of the breast all members of our profession still agree that operation is indicated. But statistics show that one out of every five early cases, that is before there are microscopic cancer cells in the axilla, die from cancer. So we believe anteoperative radiation should be advised even in operable cases. Every patient who is unfortunate enough to be the subject of carcinoma of the breast should have every possible chance to live free from disease as long as possible. Recurrence is a real menace and every effort should be used to prevent it.

The surgeon doubts the value of any procedure which delays surgical removal. But every case will show a definite diminution in size if radiated efficiently. At the time of operation there is a smaller amount of malignant tissue to remove with less danger of local implantation and less danger of dissemination through the lymphatics.

TECHNIQUE.

An early operable carcinoma of the breast should have one complete series of deep x-ray treatments, cross firing where possible, particularly around the axilla, supra-clavicular region and mediastinum. It has been our habit to use packs of radium over the growth and in the axilla if there is any suspicion of glandular enlargement. Three weeks later radium needles are imbedded into the growth and in three to four weeks the cases are turned over to the surgeon. Imbedding the radium allows parts of the growth to have a full dose of radium that would only receive a partial dose by surface application. The lymphatics may reasonably be considered sealed and the outlying cells are incarcerated or destroyed. Removal can be accomplished with expectation of a permanent cure. A month after removal a second thorough course of treatment is given and as a rule this is not repeated again. The treatment of the axillary and supraclavicular areas are repeated as often as the skin will tolerate the treatment.

The best diagnostician living cannot tell absolutely when a case has or has not progressed past the borderline. Very few surgeons operate on inoperable cases, but many surgeons operate on a borderline case, honestly convincing themselves that they are doing what is best for the patient. It is important enough to repeat again that four out of five cases with axillary involvement die from recurrent carcinoma. So why not advise thorough, competent radiation given by some one adequately trained in order to decrease that percentage of recurrences.

The treatment of hopelessly inoperable and recurrent cases consists of applications of radium packs over the mass and in the axilla

and supraclavicular regions in addition to a complete series of deep x-ray treatment. This is followed in three or four weeks by insertion of radium needles into the tumor mass. We are treating some of these cases with the 180,000 volt deep therapy machine, but the time is too short to report any results.

RESULTS.

We have obtained best results in the treatment of carcinoma of the breast by using a combination of radium and deep therapy. Skin nodules are always treated by radium, often by inserting radium needles directly into the nodules. They seem to actually melt away under the influence of radium. We have never been able to obtain the same results from x-ray treatment of these nodules. Any definite localized area should be treated by radium. A more intense radiation can be given to a small area without injury to healthy surrounding structures. X-ray therapy is used for all large areas. Radium inserted under and through the growth has a decided advantage over superficial application. The results are spectacular and the actual decrease in the size of the growth can be noted from day to day.

Clark, John G., M.D., and Frank G. Block, M.D., Philadelphia. Treatment of Inoperable Cervical Cancer." American Journal of edical Sciences, May 1922, p. 769.

FILE UNI

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Cervix, Canc

"Anyone familiar with the subject will realize that there are more cervical cancers that are inoperable when first seen than there are cases suitable for the radical operation. Radium has been of inestimable value in the palliative treatment of the inoperable cases; but unfortunately, radium is available to a comparatively small number of the profession, while the inoperable cases of cancer of the cervix are of necessity left to the care of practically all the general practitioners, many of whom are at a loss to apply any treatment as a palliative. In view of these facts Gellhorn (Jour. Missouri Stated Med. Assn., 1922, 19, 59) calls attention to a method of treatment which he originated fifteen years ago and which he considers second only to radium in the suppression of the awful symptoms of inoperable cancer of the uterus. The technic is briefly this: The cancerous masses occupying the cervix are scraped or scopped out with a curette, or, better still, with a very large, sharp spoon. This may require a few whiffs of ether, or chloroform, but in many cases a preliminary injection of morphine renders this short initial step painless. Do not lose time with attempts at checking the bleeding, which is usually abundant, but raise the foot end of the examining or operating table and insert into the vagina a well-lubricated Ferguson or other tabular speculum. Pour into this speculum a tablespoonful of pure acetone, which will check the bleeding immediately. Lower the speculum after about ten minutes and permit the acetone and clotted blood to run out, and fill the speculum once more with pure acetone. The speculum is now held in place for about ten minutes or twenty, usually by the patient herself, after which time the table is lowered so that the fluid will run out of the speculum. The latter is then withdrawn. No packing is left in the vagina. There is absolutely no pain connected with this procedure, provided that the acetone does not touch the vulva. Even a single drop of acetone upon the mucosa of the vulva would cause an intense burning, which, however, can be relieved at once by washing it off with water. It is for this reason that a tubular and not a bi-valve speculum must be inserted, and that the amount of acetone used must not be so large as to run out and over the vulva. The treatment as outlined above is repeated every two days for at least three weeks, except that the curettage is omitted. Later the intervals between treatments are lengthened to three or four days, and as the condition responds to the applications, treatments are given only as the case requires. The beneficial effect of the treatment is usually very prompt. The hemorrhages are as a rule the first to disappear. The discharge becomes more watery and soon loses its offensive odor. The general condition of the patient improves fairly rapidly as appetite and strength return, and the severe pain which has interfered with sleep usually decreases to such an extent that very small doses of opiates or even salicylates suffice. Gradually the crater in the vagina shrinks perceptibly and the patient regains, for a time at least, the feeling of good health. The writer has been able to prolong life in this manner with a certain degree of comfort in hundreds of cases, but in spite of such good results he still insists that radium is the best treatment of inoperable cancer of the cervix.

Soiland, Albert, M.D., F.A.C.S., Los Angeles, Calif. "Concerning Radiation in Pelvic Cancer."* Southwestern Medicine, Feb. 1922, Vol. VI, No. 2, pp. 47-48.

FILE UNDE

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Cancer, Cervix

"My technic for a cervical carcinoma usually consists of an implantation in the cervix of 50-milligrams of radium element, with filter of one-half millimeter of silver, one millimeter of brass and one millimeter of hard rubber, for fifteen hours, giving four such applications within six days' time. This is a total of three thousand milligram hours, which is sufficient to destroy carcinomatous cells within a radius of three centimeters in all directions from the center of application. This treatment is followed by x-radiation over the lower abdomen, through four ports of entry, giving a total of six hundred milliampere-minutes in a period of six days."

*Look under cancer of uterus.

Janeway, Henry H.: The Use of Buried Emanation in the Treatment of Malignant Tumors.—*American Journal of Roentgenology,* July, 1920; pp. 325-327.

FILE U
C

Cancer of Cervix

Indications for the Use of Buried Emanation in the Cervix Uteri.

In carcinoma of the cervix, buried emanation is reinforced by the chain of tubes placed in the utero-cervical canal. The words "reinforced by" express the fact exactly, since in cervical carcinoma buried emanation is the most important part of the treatment.

(See Janeway's Chart of Dosage at Memorial Hospital, filed under D—Dosage Emanations.)

**Bottaro, L. P., and M. Becerro de Bengoa: Radium Therapy Dur-
ng Pregnancy.**—***Anales de la Facultad de Medicina*, Montevideo, May-
une, 1920, 5, No. 5-6.**

FILE UNDE

C

**Cancer of Cer
in Pregnant
Women**

This communication reports the ultimate outcome in a case previously published in which the woman five months pregnant, was given radium treatment by the vagina, for a cancer of the posterior cervix at a total of 6000 milligram hours. She was delivered at the eighth month by cesarian section of a well formed child that died ten hours after birth. The premature delivery, the cesarian section, and the lack of care for the infant during the night are accepted as explaining its death without contraindicating the radium. The case shows that cancer of the cervix yields to radium treatment during pregnancy as well as at other times. The woman died two years later.

Coffey, R. C. (Portland, Ore.): The Relative Fields of Radium, urgery and Cautery in the Treatment of Cancer of the Cervix. *orthwest Med.* **July, 1921.**

SHEET NO. 1

FILE UND

C

Cervix, Cancer

"When the patient enters the hospital with an advanced cancer of the cervix, a dose of about 2,000 to 3,000 mgm. hours of radium is applied to the cervix and inside of the uterus. A week later a similar dose is used. About four to seven days later, the operation is performed in the manner described by cooking and removal, except that the cooking through the vagina is limited to the simple destruction of necrotic tissue, or is omitted entirely. After the clamps have been placed and the uterus thus removed, radium is placed so that its rays are directed into the base of the broad ligament as follows:

"A 50 mgm. tube of radium is screened in one millimeter of brass. This brass tube is drawn into a thin rubber tube. This rubber tube is drawn into a larger rubber tube. On one side of the large rubber tube a concave plate of 2 millimeters of lead is fastened so as to shield the upper abdomen in every possible way from the action of the radium. This tube is inserted down on the back of one broad ligament, just outside the clamp. A similar tube is prepared for the other broad ligament. A 25 mgm. tube is placed in another rubber tube and placed on top of each broad ligament, directing its rays downward toward the back as the patient lies on the table. The protected quarantine pack is made thicker immediately above the radium, so that the intestines will be held well away from the radium, although it is protected by 2 millimeters of lead. The quarantine pack should surround the clamps and tubes on all sides and should protect the bladder from the radium. The ends of the rubber tubes containing radium are brought to the surface with the gauze. Thus 150 mgm. of radium is left in the abdomen for ten to twenty hours, but the dosage at this time depending on the amount of reaction which followed the preceding in the reaction of radium in different patients. The clamps and the protected gauze pack are handled just as has been described above.

"For my early cases treated in this way, I used a smaller amount of radium for a longer time. Since I have procured a larger amount of radium I am using a larger amount and removing it in a shorter time, as the prolonged presence of radium seems to make the patient much more uncomfortable. In using 150 mgm. at one time, the effect of the radium may be obtained and the radium removed before the patient has really become severely conscious of the discomfort of the radium. Some patients react very severely to radium. If this reaction is marked after the preliminary application, the intra-abdominal dose should be correspondingly reduced.

"Radium reaction is manifested by fever, rapid pulse, restlessness, general discomfort and sometimes chills. After the wound has properly healed, before the patient leaves the hospital, it may be advisable to give one more well screened dose of radium, applied in the upper end of the vagina. By thoroughly screening the radium, both with metal and by distance, which is produced by gauze packing, there is no probability of injury to the bladder or rectum. While we have been developing this technic less than two years, I think we can safely say that the results so far are very promising.

Coffey, R. C. (Portland, Ore.): The Relative Fields of Radium, Surgery and Cautery in the Treatment of Cancer of the Cervix. *Northwest Med.* **July, 1921.**

SHEET NO. 2

FILE U

C

Cervix, Can

"Some feel that deep x-ray therapy offers an additional safety. We are installing this equipment and appreciate its importance in certain cases, but in treating cancer deeply located in the cervix and broad ligaments, we feel much as we did in other years when we put an extra ingredient in one of our famous "shotgun" prescriptions. Cancer of the cervix is located in one of the least accessible places for the use of the x-ray."

**Frank, Louis: Carcinoma in the Cervical Stump After Supra-
vaginal Hysterectomy; and the Radium Treatment of Carcinoma of
the Cervix.**

FILE UNDE
C
Cervix, Carcinoma

"The coincidental development of cervical and corporeal carcinoma is unusual. The problem of etiologic relationship between carcinoma and fibromyomata remains unsolved, but it is interesting to note that uterine carcinoma occurs in women who have fibromyomata five times as frequently as in those who have no such condition. The development of carcinoma in the cervical stump after supravaginal hysterectomy is rare, less than eighty cases having been recorded in the world's literature. Radical surgery has produced few cures after the pelvic viscera have become involved in a carcinomatous process. According to Janeway, an elaborate search of the United States discovered only 61 women operated on between 1911 and 1916 who had been cured of cervical carcinoma.

The writer cites 38 cases (three of which are reported in detail) of carcinoma of the cervix treated with radium.

The three detailed cases received doses of 1200, 2400 and 3600 mg. hours, respectively. The dosage at each application was in one case 600 mg. hours, and 1200 in each of the other two. Of the 38 cases treated, 18 are well (some of them for two years), 4 show no local evidence of disease but are not well, 11 have died, and 6 cannot be traced.

Graves, William P.: Operation or Radium for Operable Cancer of the Cervix. At 45th Annual Meeting of American Gynecological **Society.** **May 24-26, 1920.** *N. Y. Med. Jour.* Nov. 6, 1920.

FILE UND

C

Cervix, Cancer

Dr. Graves reviews his experience with radium in cervical cancer. Radium had proved to be an invaluable agent in the palliation of inoperable cases. Many brilliant primary results had been achieved, but as a rule the ultimate results had been disappointing, there being only one case which he could at present confidently pronounce cured.

On account of the danger of fistula formation from burns, either before or after the operation. If the operation had been unsatisfactory so far as a complete extirpation of the disease was concerned, radium was used as a prophylactic against recurrence. In numerous borderline cases difficult of operation, the patients were treated first with radium and then operated upon. In most of these cases there were recurrences ultimately.

Dr. Graves concluded that there was as yet nothing in his personal experience with radium to justify giving up the radical operation in operable cases. He, however, called attention to the fact that the results of radium treatment observed at the Memorial Hospital. New York, were superior to his own and ascribed this superiority to a greater knowledge and experience in radium, to the possession of larger quantities of the radium element and to a more elaborate and efficient technic of application. He stated, therefore, that the conclusions from his own personal results should not be generalized at present.

Janeway, Henry H.: The Treatment of Uterine Cancer by Radium.—*Surgical Gynecology and Obstetrics,* XXIX., pp. 242-245, September, 1915. *Radium,* November, 1919.

FILE UNDE

C

Cervix

Case histories of 4 cases, 2 clinically cured, 16 and 25 months after treatment; 1 improved.

TREATMENT.

Emanation tubes applied within the cervical canal and against the cervix.

TECHNIC.

The glass emanation tubes, unfiltered, weer either embedded in the mass or used with 2 millimeter lead and 1 millimeter platinum filters. The lead filter was embedded in dental mold. The platinum filter was covered by a rubber tube, about 1.5 millimeters thick.

DOSAGE.

The average dosage in these cases was 2971 millicurie hours with extremes from 1197 millicurie hours to 8362 millicurie hours.

AFTER HISTORY.

One patient treated first 2 years ago, is still free from any evidence of disease. Another, first treated a year ago, is free from evidence of disease. A third, treated 2 years ago, has recently required another treatment and at present shows symptoms of metastisis in the upper pelvic glands. The fourth case is not improved.

Recasens, Madrid: Radium Treatment of Cancer of the Cervix.—
rchives mens d' Obstetrique et de Gynecologie, Paris, December, 1919,
, No. 12. **Abstracted in** ***Journal of American Medical Associa-***
ion, April 10, 1920.

FILE UNDE
C
Cervix

Recasens has been treating malignant disease of the cervix with radium since 1913, and many cases of supposedly inoperable cancer have been cured for three, four and five years to date. He is seeking with so many others to learn why it failed in 30 or 40 per cent. of his over 400 cases, even when conditions, structure, etc., were identical. Another astonishing feature of radium treatment is that sometimes when it seemed to have failed completely and the treatment was abandoned as hopeless, the woman returned months later immeasurably improved or even clinically cured. There had evidently been a cumulative action from the radium, and the organism had rallied some mysterious forces to its support. These mysterious forces must be discovered and harnessed in our service. The cancer and the radium both depress the numbers of leukocytes and we must seek to induce leukocytosis as an aid in the fight against the malignant disease. His experience confirms further that the toxic cachexia is aggravated by radium treatment which pours more toxins into the circulation. Before the radium is applied, the number of leukocytes must be increased and the best means for this, he says, is by the application of diathermy to the spleen. Almost at once the blood usually shows increased numbers of leuckocytes. It has long been known, he says, that the spleen has a cancrolytic action, but no means has been devised as yet that will enhance this.

No drugs were found effectual except that colloidal copper by the vein seemed sometimes to augment the susceptibility of the cancer cells to the radium, the cure being realized earlier in these than in other cases. This encourages further search for chemicals which may alone cure cancer, but for the present we can use it as an adjuvant. Numbers of chemicals were tested locally, and also diathermy but none displayed any efficiency.

To avoid secondary infections, he treats the cancer with a ten per cent. solution of copper sulphate before applying the radium and douches the vagina with a one per cent. solution. The amount of radium used is 70 mg. at eight day intervals, and the glands in the region are given supplementary roentgen treatment. The papillary form of cancer is most amenable to radium when the tube can be placed so it is completely surrounded by the excrescences of the tumor.

Brayton, Howard W., M. D., Hartford, Conn.; A. C. Heublein, M. D.: Enlarged Thymus Gland in Infancy and Its Treatment by Radium.—*Boston Medical and Surgical Journal,* December 25, 1919.

FILE UNDE

C

Thymus Gland Enlarged

"Two years ago one of the writers (H.W.B.) was asked to see an infant who was in a desperate condition from thymic asthma. Roentgen ray treatment was advised and the case referred to the other writer (A.C.H.) who suggested that, owing to the extreme severity of the case, radium be substituted in the hope that its effect might be more prompt. Radium had produced such marvelous shrinkage of certain tumors of other structures that it seemed justifiable to apply it in this nearly moribound case, even though its use in this condition had never been reported in the literature. The results of this substitution were so satisfactory that ever since radium has been used exclusively in both hospital and private cases.

TECHNIQUE.

One hundred milligrammes of radium element, in 0.3 millimetre silver capsule is wrapped in gauze so that when strapped over the chest with adhesive, it will lie half an inch from the skin surface. Four marks are made in the form of a rectangle over the thymic area and the nurse is instructed to allow the radium to remain two hours over each mark. This makes a total exposure of 800 milligramme hours.

From the moment a diagnosis of enlarged thymus is made the child's head should be kept in a flexed position, thus lessening the severity of the asthma and the possibility of sudden death.

CONCLUSIONS.

Radium does have certain advantages over the roentgen ray which may be summarized as follows: The action of radium is more rapid: with radium one treatment alone suffices to effect a cure, even in the severest forms of the disease; Radium is portable, thus obviating the difficulty of transporting the patient to a roentgen laboratory; the application of radium is simple, thus eliminating the dangerous element of fear from the mind of the patient, and at the same time rendering unnecessary the use of an elaborate X-Ray equipment and highly-skilled operator.

To date we have treated thirty-four cases of enlarged thymus with radium. In every instance there followed a prompt and lasting disappearance of all symptoms. Two of these patients died more than a month after treatment, one with influenza and the other from inexplicable convulsions. * * * *

Burnam, Curtis F.: New Growths of the Mediastinum and Radium Treatment.—*Journal of American Medical Association*, LXIX. 989-996, September 22, 1917. *Radium*, October, 1918.

FILE UN
C

Mediastinum

Clinical report of eight cases presented to show that as soon as diagnosis is made radium should be promptly used.

TREATMENT.

Radium tubes were applied to the back or to the chest.

TECHNIC.

The radium tubes were screened with 3 mm. of lead and from 1 to 1.5 inches of gauze for periods of from 1 to 4 hours for each area into which the entire surface to be treated was divided.

DOSAGE.

The average dosage was 11161 mg. hours with extremes running from 696 milligram hours to 29865 milligram hours.

Ross, J. W., M.D. (Rochester, Minn.): Cancer of the Uterine Cer-
ix. Abstracted in the *Journal of the A. M. A.*, from *Canadian Med-*
***al Association Journal*, Nov., 1922, page 12.**

FILE UNDE
C

Cancer of the
Uterine Cervix

GENERAL DISCUSSION

From Ross' study of 475 cases in which various forms of therapy were employed, it would seem that in very early cases of cancer of the uterine cervix treatment by surgery alone gives good results. Surgery in combination with radium gives slightly better results than surgery alone. In operable but not early cases treatment by surgery alone or combined with radium gives the best results. Radium alone or Percy cautery alone are of equal value and both less efficient. If radium is not available, Percy cautery should be used. In cases considered inoperable because of extension to the vagina surgery gives the best results and radium is disappointing. In inoperable cases radium, alone or in combination with cautery or surgery, is the only effective agent. In advanced cases radium is superior to all other methods but not curative. The incidence of fistula is higher with the Percy cautery than with any other method.

Wertheimer, Selma: 'Metastases from Irradiated and Non-irradiated Carcinomata of the Cervix. (Strahlentherapie, 1921, xii, Heft. 1.) *The American Journal of Roentgenology,* December, 1922, page 841.

FILE UN
C

Carcinomat
the Cervi

ON THE PERCENTAGE OF METASTASES OF RADIATION.

Fifty-four irradiated and 50 non-irradiated cases, among which there were 32 postoperative cases of carcinoma of the cervix, were particularly carefully examined at autopsy for metastases. In cases that were not rayed there were metastases in 54 per cent. In those cases that were treated by x-rays, radium, or by both, there were metastases in 48 per cent. This shows that radiation therapy of carcinoma of the cervix does not increase metastases. The liver, however, is unique, in that carcinomatous metastases were found in 26 per cent of the irradiated cases, and in 14 per cent of the cases not rayed.

Janeway, Henry H.: The Use of Buried Emanation in the Treatment of Malignant Tumors.—*American Journal of Roentgenology,* July, 1920; pp. 325-327.

SHEET NO. 1

FILE UNI

D

Dosage
Emanatio

Gives the conclusions reached at Memorial Hospital, New York City. After a year's additional experience, has better defined the indications for burying emanation, has more accurately standardized the dosage, and has enhanced the value of the results by increasing the duration of the post-therapeutic period in many patients. * * *

The chief advantages of embedded emanation for the growths of the mucous membrane (Mouth, Rectum, Cervix Uteri, Prostate and Bladder, Breast, Lymphatic Glands, Sarcoma) are the accuracy of the primary application, the economy in the use of radium and the ease with which residual incompletely treated remnants of the tumor left after the initial treatment may be destroyed by embedding emanation in these remnants as soon as they are identified. Often one such supplementary treatment of the tumor process is sufficient to dispose of a growth from which otherwise a fatal recurrence would take place. The most important detail in the successful treatment of these growths is the correct interpretation of the changes in the post-therapeutic period.

Dosage: It is difficult to formulate rules for dosage, and such rules are always subject to modifications imposed by the special conditions present in any case.

The volume of the tumor is the most important factor in determining the dose, but the shape of the growth is of almost equal importance and influences the dosage hand in hand with the volume. An elongated superficial growth will, for instance, require almost the same dose as a circular superficial growth with a diameter equalling little less than the long axis of the elongated tumor.

A flattened tumor with little deep infiltration requires approximately the same dose as a spherical tumor with a diameter equalling the long diameter of the flattened growth. Between these variously shaped tumors there is a great difference in cubical volume, but the difference in the number of millicures required by them is not proportional to this difference but rather to the difference in the number of square centimeters in the plane of the tumors largest diameter.

For these reasons the diameters of tumors are the most practical guides to the doses required by them.

The following table illustrates approximately the dosage of buried emanation which we are using at the Memorial Hospital for expidermoid carcinoma, many spherical breast tumors and sarcomas.

In using the dosage of this table it must be remembered that an important difference exists in the radiation which the tissues receive when exposed for equal periods to embedded emanations and radium elements, the former in undergoing continuous decay and the latter remaining of constant strength.

Janeway, Henry H.: The Use of Buried Emanation in the Treatment of Malignant Tumors.—*American Journal of Roentgenology,* **July, 1920; pp. 325-327.**

SHEET NO. 2

FOR CIRCULAR AND APPROXIMATELY OVAL TUMORS OF THE SAME LONG DIAMETER.

Diameter.	Deep Infiltration.	Surface Area.	Dosage.
1 cm.		.77 sq. cm.	5 mc.
1½ cm.		1.7 sq. cm.	8 mc.
2 cm.		3.14 sq. cm.	10 mc.
2½ cm.	Not more than 1½ cm.	4.8 sq. cm.	15 mc.
3 cm.	Between 1 and 2 cm.	6.5 sq. cm.	17.5 mc.
4 cm.	Between 1 and 2 cm.	12.5 sq. cm.	20 mc.
5 cm.	Between 1 and 2½ cm.	19.3 sq. cm.	22.5 mc.
6 cm.	Between 1 and 3 cm.	28.27 sq. cm.	25 mc.

For spherical tumors there is little difference.

Diameter.	Area of plane of diameter.	No. of cubic cm.	Dosage.
1 cm.	.77 sq. cm.	.52 cb. cm.	5 mc.
1½ cm.	7.7 sq. cm.	1.70 cb. cm.	8 mc.
2 cm.	3.14 sq. cm.	4.18 cb. cm.	10 mc.
2½ cm.	7.8 sq. cm.	8.19 cb. cm.	15 mc.
3 cm.	6.5 sq. cm.	14.08 cb. cm.	20 mc.
4 cm.	12.5 sq. cm.	33.44 cb. cm.	22 mc.
5 cm.	19.3 sq. cm.	65.29 cb. cm.	25 mc.
6 cm.	28.27 sq. cm.	112.86 cb. cm.	30 mc.
7 cm.	38.48 sq. cm.	180.03 cb. cm.	35 mc.
8 cm.	50.26 sq. cm.	251.52 cb. cm.	40 mc.

Franklin, Walter S., and Cordes, F. C., San Francisco: Radium for Cataract.—*American Journal of Opthalmology*, September, 1920; pp. 643-647.

SHEET NO. 1

FILE UNDI

E

Cataract

Reports results of studies with 31 cases on the influence of radium in lens apacities in the Department of Opthalmology in the University of California.

"Of the 31 patients under observation, 84.3% showed a change for the better ranging from an improvement of 3-4 letters on the test chart to a complete disappearance of the process. In the cases that showed a marked improvement, the apacities were very definitely thinned out; one of these, a very early nuclear cataract, disappeared entirely leaving no trace of the opacities. In no instance where there has been an improvement has there been any retrogression to date, however, the time of observation has been too short to determine whether or not the cataract will eventually go on to maturity.

"Twenty-one of the cases treated were private, the remaining ten being clinic patients. The percentage of improvements was much higher in the private cases. This is explained by the fact that due to the difficulty of obtaining the radium for the Out-Patient Department, these individuals did not receive the exposures systematically in many instances. This emphasizes the necessity of frequent systematic treatments in the beginning.

"Radium is of proven value in the treatment of incipient cataracts. Our findings correspond sufficiently well with those of Levin and Cohen to indicate that it is not merely a coincidence but that actual results are obtained. Although the vision cannot be brought up to normal in many individuals, the ultimate outcome is superior to an aphakic eye such as is obtained by surgery and does not subject the patient to the surgical risk of such a procedure.

TECHNIC.

"We are using 9.95 mg. of radium element in the form of radium barium sulphate in a circular gold plated glazed plaque over an area of 50.26 sq. mm. The apparatus consists of a specially designed silver cup to facilitate handling the radium. The bottom of this cup is made of a piece of silver 0.5 mm. in thickness and screens out practically all but the gamma rays. The cup is embedded in a block of vulcanite, the bottom of which is 0.6 cm. from the silver cup. The vulcanite is used as an easy method of obtaining a certain fixed distance and thus has the advantage over gauze pads. The container is now applied on a lead plate 1 mm in thickness. This plate is shaped to cover the eyebrows and lashes and extends over the cheek a short distance. Directly under the radium is a hole 8 mm. in diameter (the diameter of the radium plaque). The lead plate acts as an additional safeguard against alapecia of the eyebrows and lashes and gives a convenient method of applying the radium. There is some doubt as to the harm done by secondary rays, which in this apparatus would be given off by the lead plate, and to prevent the possibility of injury from these rays, a piece of rubber dam is placed as an additional safeguard, below the lead plate.

"The patient is placed in the prone position and the lids of the eye under treatment held closed by applying a small strip of surgeon's isinglass plaster. A small gauze sponge is placed on the eye to prevent the apparatus from coming in direct contact with the patient.

Over this gauze sponge the radium apparatus is placed and held in position by two tapes and two small pieces of adhesive plaster. The patient is told to fix the ceiling with the uncovered eye, thus bringing the lens of the eye under treatment more directly under the radium. In this method, the radium is about 1.2 cm. from the eye.

DOSAGE.

"The matter of dosage is rather an uncertain one, varying with each type of radium applicator. A milligram hour is the exposure to one milligram of radium for one hour. * * * In most of our cases, we have been giving 10 milligram hours twice a week for four weeks and thence once weekly until the process is stationary. Following this, one exposure is given monthly. Experimentally it has been shown that the normal tissues of the eye are more resistant to the radium than the tissues of the skin, therefore, the lid gives a valuable indication against an overdosage, as a reaction would take place here before any injury could be done to the structures of the globe. In one of the earlier cases there was a mild reaction when less screening was used. The erethema of the lid passed away within a few days. No other reactions have been observed.

"A radium emanation plant has been installed at the University Hospital and we are now using radium emanation in the treatment of a series of cases. The tubes are screened with silver so that the silver cup is omitted in the application; with this exception the method remains the same. The length of exposure varies according to the strength of the tube. The dosage given is equivalent to 10 milligram hours. For example, if a tube checks up as equivalent to 20 milligram gamma radiation, the time of exposure would be for half an hour. It is too early as yet to give the results with this method.

"Before starting the radium therapy, the vision and apthalmoscopic findings were carefully noted. Every month an examination was again made and the above recorded. When the vision remained stationary for one month, an application of 10 milligram hours every four weeks was found to hold the improvement.

CONCLUSIONS.

a. The application of radium does no injury to the normal structures of the eye.

b. It apparently has a selective action upon the lens.

c. Radium improved the vision in 84.3% of our cases.

d. A consistent technic and known dosage seems advisable.

e. Frequent treatments are necessary in the beginning.

Levin, Isaac, M. D., New York City: Technic of Radium Applications in Cataracts.—*American Journal of Roentgenology*, February, 1920.

FILE UND

E

Cataracts

TECHNIC.

A small glass tube containing the radium salt or the radium emanations is placed in a brass capsule 1 mm. thick. The capsule is covered with about 2 cm. of thickness of black photographic paper and as much gauze. The whole is placed over the closed eyelid. The applications last two hours. * * The treatments are repeated at first every week and later at longer intervals in accordance with the results of the opthalmalogical examinations. The treatment once in two to four months should be continued for at least two years, since the cataract is a slowly developing disease.

DOSAGE.

The quantity of radium used, equals 25 milligrams of radium element. At the beginning of the treatment much larger quantities of radium were employed without injury to the eye, but the smaller quantities appeared to be quite as effectual.

Cohen, Martin, M. D., Levin, Isaac, M. D.: Action of Radium on Cataracts.—*Journal of American Medical Association,* Vol. 73, October 18, 1919.

FILE UND

E

Cataracts

Gives clinical history with colored pictures of 24 cases. Improved vision.

TECHNIC.

Glass tubes containing 20 to 40 milligrams of radium element were screened with brass, photographic paper and gauze and placed over the closed eyelid. The distance between the radium and the eyelid was about 2 cm. The application lasted two hours.

AUTHOR'S SUMMARY.

1. Application of radium to the eye is harmless. 2. There is no diminution of lenticular opacification under the influence of radium. 3. Should a cataractous lens become matured subsequent to radium treatment and should then an operation be required, no difficulties will present themselves. 4. It is therefore advisable to submit a sufficiently large number of immature cataracts with useful vision to a proper course of radium treatment so that a correct estimate of the value of the method may be obtained.

Knox, Dr. Robert, London: Radium in Diseases of the Eye.—Part II.—*Radiography and Radio-Therapeutics*, 1919, third edition, p. 516.

FILE UN

E

Eye

Mackenzie Davidson has called attention to the marked effect of radium in diseases of the eye, trachoma, conjunctivitis and catarrhal folliculitis.

TREATMENT.

Short exposures are recommended and the radium should not be screened to any extent.

TECHNIC.

The radium enclosed in a glass tube, or very thin metal applicator, and a very few minutes' exposure is all that is necessary. Each case must, however, be treated on its merits, and if short exposures do not produce the effect wished for, the time of exposure must be increased.

Lawson and Davidson: **Radium in Eye Conditions.**—*Brit. Med. Jour.* Nov. 12, 1920, p. 149.

FILE UND
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Eye Conditions

Lawson and Davidson in 1910 used radium on a variety of cases. In their report their method is carefully described. The eye was cocainized and the radium (beta and gamma rays only) was applied directly to the affected part. The fingers of the operator were protected by enveloping first that part of the tube not required, then the fingers in a thick continuous wrapping of lead foil. The process was tedious. They used 20 milligrams of the element, with exposures from five minutes to half an hour. The frequency of exposure was governed by the progress of the condition. They reported on approximately 80 per cent. of the cases, and noted no ill effects.

Bell, G. H., and Tousey S.: Non Operable Tumor of the Orbit nd Brow Treated Successfully with Radium. Report of a Case With Few Remarks.—*Arch. Opth.*. 1919, Vol. XLVIII., 531. Abstracted, *urgery, Gynecology and Obstetrics*, April, 1920, p. 319.

CASE HISTORY.

The patient was a woman 65 years of age who about nine months previous to her appearance at the clinic had received a blow on the forehead. Subsequently a lump had appeared which at times was painful. Although Wassermann tests were negative, she had been given antisyphilis treatment for six months.

At the time she came to the hospital she had an enormous tumor of the orbit and brow. The cornea was ulcerated and perforated and there was bleeding of the tumor. The entire orbit was filled with the growth, the lids were greatly swollen, and the cornea could be seen projecting between the lids.

The Wassermann test was again negative. The X-Ray findings indicated a tumor mass filling the entire orbit and softening of the bone in parts of the orbital walls.

Applications of 20 mg. of radium salt of two million activity were made. The radium was enclosed in a sealed glass tube which was enclosed in an aluminum treatment tube. The aluminum tube was then wrapped in a lead wrapper about 1/50-in. thick and placed in the soft rubber cover from an Oberlander urethrometer. For treatment the tumor was divided into points 1½-in. apart. The radium was left in each point for one hour at a sitting. At first the growth was so large that there were six such areas.

Two weeks after the first treatment a shriveling of the skin was noted. The tumor then began to subside quickly, the decrease in size being so rapid that toward the end of treatment the radium was applied to only two areas. At no time were there any cutaneous reactions. The first treatment was given December 19, 1917, and the patient was pronounced cured April 1, 1918. At the latter date the shrunken globe that remained was removed under local anæsthesia.

The cosmetic result with the use of prosthesis was perfect. No laboratory report is offered, however, as the patient was so weak that it was thought best not to subject her to the added operation necessary to procure a specimen. The authors are confident, however, that they were dealing with a sarcoma.

Mention is made also of the use of radium in eye conditions by others. The work of Aikens in cases of rodent ulcer, vernal catarrh of the eyelids and exophtalmic goiter is cited, as is also that of Axenfeld who successfully treated a glioma in a child. Clarke treated a sarcoma of the orbit by doing a canthotomy and after splitting the external rectus muscle inserting a tube of radium which he left in place for a period of four hours. This procedure was repeated every two weeks. A nuclear cataract which developed after six months might possibly have been due to the radium.

Five cases of leucosarcoma in which Clifford obtained good results with radium are reported. Radium is especially advised when the tumor growth is slow as in tumor growth of the iris.

The authors are convinced of the great value of radium in the treatment of tumors of the eyelids, orbit, and brow when syphilis can be ruled out and believe that it should be given a trial before resort is had to surgery. When syphilis and tuberculosis can be ruled out it may be used also for tumors of the iris and should be seriously considered for all other intra-ocular tumors. In the treatment of epithelioma of the eyelids radium is the best agent at hand as the dosage can be readily controlled. In spring catarrh it seems to be almost a specific. Before radium is used as a therapeutic agent, a search should be made for sources of focal infection.

J. S. Clarke.

Shumway, Edward A., Philadelphia, Pa.: Vernal Conjunctivitis—
s Treatment by Application of Radium.—*Pennsylvania State Med-*
ol Journal, September, 1919.

FILE UND
E
Vernal Conjunctivitis

"In recent years, however, as the result of the reported experiences of Abbè, Lawson, Schnaudigel, Shine, Harrison, Butler and Allport, we have been employing radium with very gratifying results." * * * * *

CASE HISTORIES.

Cites the technique of Dr. Henry K. Pancoast upon a boy of eleven years who had been treated for five years at the eye dispensary of the University Hospital, without success, until in 1917, he was given a series of radium treatments. Dr. Pancoast applied from 35 to 50 milligrams of radium to the eyelids, the average time of exposure being fifteen minutes, and the result was the complete disappearance of the lid growths in four months time. A slight recurrence was cured by one treatment.

Cites the fact that Doctor Pancoast treated four other patients for the author. One of these, "the most extensive I have ever seen," was in a young man 22 years of age, who had been treated for trachoma for several months. He was given four treatments from April to August and now shows very marked improvement, the greater part of the tarsal surface being free and showing very little roughening. In the other case, a girl of eight, after two treatments with 50 milligrams, for twenty minutes at each application, the lid growths entirely disappeared and the conjunctiva shows practically no scarring. In the third case, with moderate limbus thickening, and a general thickening of the palpebral conjunctiva, in a girl of eight, the limbus nodules disappeared, and except during the very hot weather of the past August, the child's symptoms were distinctly ameliorated. In the fourth patient, a young man of seventeen, with limbus thickening and marked hyperthrophy of the conjunctiva suggesting a case of trachoma complicated by vernal catarrh, which was referred to me by Dr. P. N. K. Schwenk, one treatment with 50 milligrams of radium produced a very decided reaction, with a slight burn of the conjunctiva, and a subsequent punctate cloudiness of the cornea. Appropriate treatment cleared up the corneal opacities, but the patient declined further radium treatments. The three pronounced palpebral cases, therefore, have been unqualified successes; one of the limbus type was greatly improved, and one patient refused treatment because of the reaction.

TREATMENT.

Cocain is instilled, and the upper lid is everted by a pair of catch forceps, which are held in position against the forehead by a strip of adhesive plaster. The radium is inclosed in a tube of aluminum, 5 mm. in thickness, and applied directly to the exposed conjunctiva. At first the tube was fixed in one position, in a clamp, for the time of treatment which averaged fifteen minutes, but the cases showed a superficial white slough of the conjunctiva, at the point of contact, and in the later treatments the nurse has been instructed to move the tube to different positions, and the burn has been avoided. Most of the patients show some skin reaction, in the form of an erythema of the lower lids, and a loss of the eyelashes. The latter, however, have grown in again in every instance after several months.

CONCLUSIONS AND DOSAGE.

"We believe, therefore, that we can claim that the method is of great aid in curing these otherwise intractable cases. William Allen Pusey, of Chicago, has recently reported success with the use of small amounts of radium, applied daily in varnish, in moderately pronounced cases, but we have found that in the bad types, the use of from 35 to 50 milligrams for fifteen minutes, at intervals of two to four weeks, depending on the resulting reaction, have given us the most satisfactory *improvement* and we believe the treatment should *be better known, and more often* employed."

Bumpus, Herman C., M. D. (Rochester, Minn.): **Discussion adium in Urology. Section on Urology 73rd Annual Session Ameri-l Med. A.** *J. A. M. A.* Nov. 11, 1922, p. 1689.

FILE UNI

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Cancer of Prostat

"In order to be successful, the exposures must come from multiple areas, and if the needles are placed in the gland alone, and the periphery of the growth is not irradiated, all the cells will not be reached. When the growth can be cross-fired every position of the needle is a new method of combating the disease. Dr. Herbst's method of putting the needles in the bladder is still another method. The offensive must all be put over in one wave. To give one treatment and then have the patient return for further treatment does not give the most successful results. The men working with other types of malignancy believe that the best results from irradiation must come from the first treatment. I believe that insufficient radium stimulates.

If the periphery is treated through the rectum, and the center of the growth with needles and through the urethra, and sufficient dosage is given, stimulation will not occur. Since 1915, we have treated 217 cases of carcinoma of the prostate with radium.

THE USE OF NEEDLES.

The early cases were treated with radium applications in the urethra and rectum, the center of the gland being neglected, and the results were not much better than in the untreated cases. We therefore changed from this form of treatment to the use of needles, and the results were still poorer, because the periphery, where the greatest cell activity occurs, was neglected. So for three years we have given the radium from all possible points of application, and the results are much better.

DOSAGE.

"We have found that the average maximal dose is 2500 to 3000 mg. hours. We have tried to give higher dosage, but distressing sloughs had resulted.

TECHNIC.

"The dosage is given approximately as follows: from 500 to 1000 in the urethra by means of bare tubes; from 400 to 600 in the rectum, and from 1500 to 2000 with the needles through the perineum We use four needles containing 12.5 mg. and allow them to remain in position for four hours: they are then pulled out one centimeter and remain a second four hours: thus eight areas, approximately 1 cm. have been rayed. If this dosage is repeated after the urethral and rectal treatments have been given, approximately eight more areas are exposed."

Levin, Isaac, (New York City): Intraperitoneal Insertion of Buried Capillary Glass Tubes of Radium Emanation. (Results In Two Cases of Tumor of the Gastro-Intestinal Tract). *J. A. M. A.*, **Dec. 16, 1922, pp. 2074-76.**	FILE UNDE G **Cancer of Gastro-Intestinal Tract**

CONCLUSIONS.

The efficiency of the method is evidenced by the results obtained in these two cases and others to be reported later. The intratumoral insertion of radium emanation produces no general deleterious effect on the organism, and at the same time in every instance causes a shrinkage of the tumor mass. The method seems, therefore, to be of great promise, and should be tested by all surgeons and radiotherapeutists who are in a position to obtain the capillary tubes of radium emanation.

The insertion of radium emanation does not add in the least to the hazard of the operation.

[illegible] New York [illegible]
[illegible] Glass Tubes of [illegible]
[illegible] of the [illegible]
[illegible] 1976.

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[illegible] the [illegible] at the [illegible]

The [illegible] of radiation [illegible]
[illegible] hazard of the operation

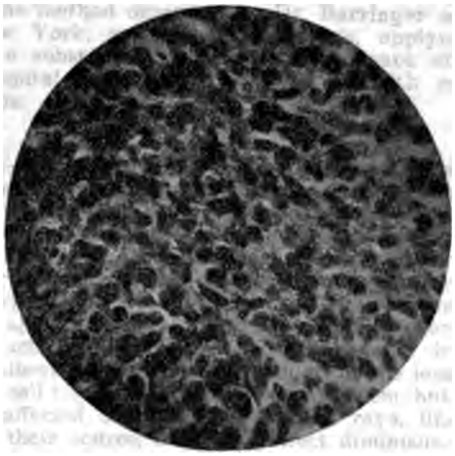
Bumpus, Herman C., Jr., M.D. (Rochester, Minnesota): "Radium in Cancer of the Prostate." Report of 217 Cases. *Journal of the A. M. A.*, Vol. 78, p. 1374, May 6th, 1922.

"Before treating patients with carcinoma of the prostate with radium, or judging the results of such treatment, metastasis must be excluded. The frequency with which metastasis occurs in these cases is not fully appreciated unless routine roentgenograms are made. In 297 of the series, plates were made of the chest, spine or pelvis, and in 84 (28.28%) metastasis was demonstrated, the greater number most commonly in the lumbar sacral region. Sixty-one of the 218 roentgenograms of the spine and pelvis showed metastasis, and only eight of the 218 roentgenograms of the spine and pelvis showed metastasis. As a matter of fact, it is unnecessary to search the chest for evidences of metastasis, since it probably never occurs there unless it is also in the pelvis or lumbar region. I have often called attention to the fact that metastasis often occurs without symptoms, before the appearance of cachexia, and in patients whose prostate glands are comparatively small. The detection of metastasis in 28% of all patients examined reduces materially the indications for radium treatment. From the facts that 73% of 113 patients with metastasis examined at the Mayo Clinic died during the ensuing year, and the average length of life after examination was seven months, it does not seem justifiable to treat a patient with radium simply for the local effect obtained on the original growth. Exception to this might be made if the local results of radium treatment could be depended on to relieve obstruction, diminish residual urine, or relieve pain. Although in occasional cases benefit is obtained in one or more of these ways, our experience has not been such as to warrant giving radium for these conditions alone when there is no hope of prolonging the patient's life. A permanent urethral catheter or simple suprapubic drainage gives better immediate results and is less trying to the patient than are large doses of radium."

"If patients with glandular metastasis alone are added to the 28% of patients whose metastasis is detected by the roentgen ray, it seems a conservative estimate that one-third of all patients with carcinoma of the prostate will be unfit subjects for radium treatment because of metastasis. In the remaining two-thirds, many complain of pain of recent onset, in the lower back, often with radiation down the outside of the thigh or around the hips. Such pain is pathognomonic of involvement of the lymph nodes of the sacral promontory and aorta which drain the prostate, and because of their deep-seated location are not demonstrable by physical examination. More often patients complain of recent attacks of sciatica, evidence of periprostatic extension of the malignancy. Our experience agrees with Dr. S. S. Barringer's (Memorial Hospital, New York), that the irritation produced by nerve pressure is uninfluenced by radium treatment, even if the tumor is considerably reduced in the prostatic area.

"Besides patients with demonstrable metastasis are those whose renal function has been reduced by obstruction and whose general physical condition is such that treatment by radium is contraindicated. Such treatment is not without danger, and if sufficiently large doses of radium are given, an added burden is necessarily thrown on the excretory mechanism. The tissue destroyed by the radium must be absorbed and eliminated, and if this task is added to an already de-

ficient renal mechanism the result may prove fatal. Therefore, before undertaking the destruction of a malignant prostate by radium, the urea content of the blood should be determined and the usual tests of renal function should be taken as before surgical procedures. Small doses of radium may be given without great danger; but, if sufficient amount is applied, renal function must be adequate to handle the absorbed tissue. I believe that after excluding the several types referred to, radium treatment will be indicated in considerably less than half the cases examined."



Group 1. The radium was used in the form of a 50- or 100-milligram capsule. At first a lead and brass shield was used in the rectal applicators; in the urethral applicators the standard silver container was the only filter. Both proved unsatisfactory, and, after several applicators had been tried, the following was adopted:

A No. 10 soft rubber rectal bougie marked off in centimeters, with a window cut in the side to hold the radium tubes, is used in making applications by rectum. The size of the bougie keeps the rectal mucosa, except the area to be exposed, sufficiently far away to reduce the exposure to a minimum, and does not cause the secondary beta rays that occur when the metal shields are used. The bougie is inserted first so that the window is in the vesical area. Each hour it is withdrawn 1 cm. to expose new areas of mucosa. This method has proved less irksome to the patient than a stationary applicator attached to bed or table. For urethral work, nothing has proved so satisfactory as a rubber covered brass receptacle attached to a piece of soft solder. The flexibility of the solder permits any curve of the prostatic urethra to be met, and enables the application to be applied at several areas. The applicator is withdrawn the length of the capsule each time, and the handle, bent over at the urethral meatus, affords fixity of position.

The amount of radium given by these methods has varied, since the treatments were given in the earliest cases. The rectal and urethral applications were alternated. The rectal dosage averaged 1,482 mgm. hours, and the urethral 217. The rectal dosage represents overirradiation. Experience has since taught that from 400 to 600 mgm. hours represents the maximum of safety in rectal applications, especially if needles have also been used and the mucosa thus cross-fired. However, fifty patients were treated by this method and completed records have been obtained from forty. They lived an average of forty-five months after the onset of symptoms. The method was discontinued because of the proctitis produced by overdosage, and the method described by Dr. Barringer of the Memorial Hospital, New York, was adopted, that is, applying the radium directly to the substance of the gland by means of needles. The Memorial Hospital very kindly supplied us with such emanation-bearing needles.

Group 2.—37 patients were treated by inserting needles directly into the gland through the perineum. The average dosage was approximately 2,000 mgm. hours. Completed records of 27 cases show that they lived an average of fourteen months after treatment, and that the duration of the disease from the onset was forty-five months, slightly longer than the average for patients not treated. These poor results are explainable by the fact that by abandoning the rectal and urethral applications the periphery of the growth, where the greatest cell activity occurs, was not thoroughly irradiated. The needles were allowed to remain long enough in one location to destroy the malignant cell tissue immediately around them, but the tissue was only slightly affected beyond. The radium rays, like light, diffuse as they leave their source, and their effect diminishes progressively. Therefore, instead of stimulating fibrosis and hyalinization, the natural barriers of malignancy, destruction of only limited areas of malignant tissue had resulted. At the Memorial Hospital, New York, results of the work with buried emanation have shown that 0.5 millicuries of emanation, when buried in tumor tissue, affects an area approximately 1 cm. in diameter, and that to increase this dosage to three or four times this amount, does not increase the area irradiated appreciably, but causes marked destruction of cancer tissues with resulting necrosis. Each half-millicurie emits 66-millicurie hours; this is equal to a needle containing 12.5-milligrams of radium in place for five hours. Therefore, keeping needles containing 12.5-mgm. in one position for from twelve to twenty-four hours causes localized necrosis and sloughing. The desired minimal dosage is obtained by leaving a needle bearing 12.5-mgm. of radium in one position for five hours, and then withdrawing it 12 mm., the length of the radium bearing portion, in order to irradiate a second area of 1 cm. in diameter. By using four needles at once and changing their position three times, twelve such areas, or twenty-four areas in two treatments, will be irradiated, affording approximately 1,500 mgm. hours of irradiation. If to this, 600-mgm. hours in the rectal exposure and 400-mgm. hours in the urethral exposure are added, the maximum of malignant tissue is affected. In this way it is possible to avoid the necessity of giving from 4,000 to 5,000 mgm. hours of exposure,

Bumpus, Herman C., Jr., M.D. (Rochester, Minnesota): **"Radium in Cancer of the Prostate."** Report of 217 Cases. *Journal of the A. M. A.*, Vol. 78, p. 1874, May 6th, 1922.

with the danger of slough and fistula formation, and the so-called radium reactions incident to heavy dosage, which are really due to absorption of the toxic necrotic tissue destroyed. It has been our experience that approximately 2,500 mgm. hours is the maximal dose that may be safely given, even in the largest glands, without producing sloughs.

Group 3.—On the supposition that the poor results obtained from the use of rectal and urethral exposures alone, or from the use of needles alone, was attributed to the fact that not all of the cancer cells were reached by the radium emanation, the last 127 cases were treated by a combination of the three methods. The completed records show that the average dose of radium was 1,960.45 mgm. hours. Sixty patients (72.28%) are dead; they lived an average of eleven and twenty-five hundredths months after treatment; 66% died the first year. The duration of the disease in the patients who died, (thirty-three and sixty-seven hundredths months) is approximately the duration of the disease in untreated patients; twenty-three (27%) are alive, the duration of the disease having increased to forty-seven and thirty-three hundredths months, and the time since their last treatment to twenty months, an extension of approximately one year in each.

Whitcher, B. R., M.D. (New York City): **"Blood Changes in yelogenous Leukaemia Following Radium Treatment."** *Boston edical and Surgical Journal.* Vol. 187, No. 10, Sept. 7, 1922.

FILE UND

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Myelogenous
Leukaemia

"Until about ten years ago the disease was considered hopeless, but today a patient afflicted with this disease may be greatly benefited and marked improvement in his general condition brought about, not only by the judicious and persistent use of x-ray treatment, but by careful and persistent use of radium. By careful examinations of the patient's blood, improvement under such treatment may be observed."

Dr. Whitcher makes a very interesting and detailed report of a case treated at the Post Graduate Medical School, the technic being outlined as follows:

"Usually 100-mgm. of radium were applied over the enlarged spleen, the site of the application being changed to a new skin area every hour until fourteen hours had elapsed. The radium was contained in a glass tube encased in a gold tube 0.1 mm. thick, the whole being contained in a brass tube 1.5 mm. thick and a screenage of 3 mm. lead and 3 mm. of rubber and a towel folded to a thickness of 2 cm. was interposed between the brass tube and the patient's skin. The radiation therefore consisted of what is designated as gamma rays. The radium dose was given on the average of twice a month for the first two or three months (the last twice with 120 mgm.) and from then on with doses from 55 to 60-mgm. of radium about once a month. With 60-mgm. of radium the treatment was applied over six successive areas over the spleen for three hours on each area with screenage of 1 mm. rubber and a folded towel 2 cm. in thickness. The last few treatments given were with 100-mgm. in four successive applications of four hours each."

"Caution is necessary in regulating the amount to be applied, lest an excessive amount of radium or too frequent application cause undue destruction of the leukocytes and so injure the reproductive powers of the bone marrow that a rapid leucopaenia and anaemia result."

Williams, Francis H., M.D. (Boston City Hospital): "The Treat-
ient of Tonsils by Radiations from Radium Salts Instead of Opera-
on." *Boston Medical and Surgical Journal.* Vol. 187, p. 412, Sept.
, 1922.

SHEET NO. 1

FILE UND

G

Tonsils

The basis of the use of radium is the fact that lymphoid tissue, of which the tonsils and adenoids are composed, is especially susceptible to its radiations, and further, that the diseased tissue in the tonsil is less resistant to them than the normal. Radium should not be depended upon to get rid of fibrous tissue or pus. The presence of pharyngitis or laryngitis, so far as I have seen, does not contraindicate the employment of radium. In carrying out this treatment it seems desirable to use the radiations of radium rather than of emanation, as these radiations are uniform and thus permit of accurate dosage in a simple and convenient manner. The radiations from radium salts are, I believe, more suitable for the treatment of tonsils than the x-rays because the former are uniform in output and thus permit of accurate dosage; and further, because the radiations from radium salts are applied through the mouth to the tonsil and are nearly all absorbed by the tonsil itself, whereas the x-rays, being applied from the outside of the jaw to the tonsil, are absorbed to a large extent by the intervening tissues, where they are not desired, the parotid gland being especially susceptible to them, before they reach the tonsil.

TECHNIC.

"The radium was usually applied in a silver container, about 6 mm. thick and about 16 mm. in diameter, with an aluminum cover 0.29 mm. thick, which acts as a filter. The container is conveniently attached to a light steel rod that has a handle on the other end, and is covered with a new rubber cot every time it is used. Various other metal filters can be placed over the front of the container to absorb certain of the radiations. The treatments, with 26-mgm. radium element were of 20, 15 or 10 minutes' duration for each tonsil, according to the filter used (which were of aluminum 0.87, 0.58 or 0.28 mm. thick respectively). I say "about" advisedly, because the length of treatment depends upon the patient's condition, the size and character of the tonsil, and what one has in mind to accomplish. The application is simple for the patient. He has only to keep his mouth open while the physician holds the container against the tonsil. The container may be removed at intervals in order to allow the patient to swallow saliva. If the throat is sensitive, a solution of cocaine may be used; in the majority of cases this has been unnecessary. As a rule, children co-operate readily."

RESULTS

"My results so far show that the method is harmless; that the tonsils have been reduced in size; that recurrences of tonsillitis have been prevented; and that some patients suffering from arthritis have been relieved."

Williams, Francis H., M.D. (Boston City Hospital): **"The Treat-**
sent of Tonsils by Radiations from Radium Salts Instead of Opera-
ion." *Boston Medical and Surgical Journal.* Vol. 187, p. 412, Sept.
4, 1922.

SHEET NO. 2

FILE UN

G

Tonsils

DISCUSSIONS.

Dr. Cadis Phipps, Boston: "I think we cannot depend upon the appearance of the tonsil alone but we can note the general feeling, and the general condition of the patient in regard to joints, headaches, sore throats, etc. I am speaking from the experience of two or three patients I have had occasion to refer to Dr. Williams, and also in my own case. I had reached the stage in my own tonsils when I felt that I must have an operation. I put it off and finally I had Dr. Williams apply radium. They shrank down to white, small, bodies and I was relieved of the unpleasant rheumatic symptoms which were putting in appearance, and my general health improved. I know the same thing is true in the case of some of my patients."

Dr. H. V. Reynolds, Brookline: "I have had several cases in adult women with tonsils diseased who refused positively to have tonsillectomy done and had radium. There was no unpleasant reaction, and the tonsils gradually melted away with no unpleasant symptoms or discharge, and with the improvement in each case such as I had seen following tonsillectomy. In fact, I could see no difference in the after-condition of the patients in tonsillectomy or removal by radium, except that there is a little contracted fibrous tissue at the base of each of the tonsils. The glandular part seemed to have disappeared. Each patient was an intelligent woman and each one is satisfied with the improvement that she has noticed from this treatment."

Bumpus, H.C., M.D., (Mayo Clinic, Rochester, Minn). "Roentgen Rays and Radium in Carcinoma of the Prostate. The American Journal of Roentgenology, May, 1922.

SHEET NO. 1

"The anesthetic is administered with patient on his abdomen. After sterilizing the sacral region with iodine, a 6 cm. needle with stylet is introduced through the sacral hiatus at the lower end of the sacrum, into the sacral canal. About 30 cc. of a 2 per cent. solution of novocaine is injected while the needle is being slowly withdrawn. After this, the patient is kept in the sitting position for from ten to fifteen minutes, while the solution diffuses through the sacral nerve sheaths. This diffisubility is greatly increased if sodium carbonate is added to the novocain. The formula is as follows: Novocain 0.6 gm., sodium carbonate 0.15 gm., sodium chloride 0.1 gm. added to 80 cc. of freshly boiled distilled water gives a sterile 2 per cent. solution of novocain in normal salt solution.

The anesthesia is complete and commences in about four minutes at the anosacral area, the exact location at which the needles are inserted. The anesthesia may be repeated at any time and the position of the needles in the gland changed, so that the new areas are radiated. After the second injection the anesthesia is much more profound and lasts from five to eight hours, permitting a third shifting of the radium-containing needles and giving the patient a period of rest and freedom from pain during the procedure. This anesthetic has been used in more than 100 instances with complete satisfaction. Patients are not longer reluctant to take a second treatment and the increased ease with which the needles are applied, owing to the complete relaxation of the rectal sphincter, adds greatly to the exactitude of the procedure, and before the completion of the treatment all parts of the gland will have been radiated.

The entire treatment is given within a few days and the patient need not return for subsequent treatments. There is no opportunity for growth of the untreated portions of the gland between treatments. Necrosis does not occur, since fibrous tissue, which greatly reduces the blood supply, has not formed as the result of previous radium treatment.

SUMMARY

1. The average duration of cancer of the prostate, if untreated, is approximately three years.

2. Roentgenograms show that metastasis to the bone occurs in about one-third of the cases of cancer of the prostate.

3. Metastasis from a typical carcinoma of the prostate, in which cells, because of their tendency to early metastasis, produce only slight local enlargement may be frequently mistaken for Paget's disease.

4. The clinical study of these cases demonstrates that in order to treat successfully cancer of the prostate with radium, it is necessary to use in the aggregate large doses (3000 to 4000 mgm. hours), exposing all parts of the gland to comparatively small doses.

5. It is demonstrated that the increased duration of life following radium treatment in cases of cancer of the prostate is in direct proportion to the amount of radium radiation applied.

6. No one method of application radiates all portions of the gland.

7. The malignant gland must be radiated by urethral and rectal exposures, and by needles inserted directly into the neoplasm in order to produce complete radiation of all portions.

8. It is demonstrated microscopically, that large doses of radium placed directly into the gland affect only a limited area; this is substantiated by the clinical findings which prove that the course of the disease after such treatments is but slightly affected.

9. In the parts of the gland affected by the radium fibrous tissue is produced which enmeshes and compresses the cancer cells, preventing their further proliferation. If this process could be brought about in the entire growth, complete cessation of the disease would result.

10. Sacral anesthesia is a useful adjunct in the application of radium needles, making it possible to place the radium accurately and to change the position of the needles without pain; thus a more thorough radiation of the gland is accomplished.

Soiland Albert, M.D., F.A.C.P., Los Angeles, Calif. "Radiation in the Treatment of Leukaemia," read at mid-year meeting of the Radiological Society of N. America, Boston, June 3-4, 1921.

FILE UND

G

Leukaemia

"The technique for radium over the spleen that we ordinarily employ is as follows: The area is divided off into squares, eight centimeters in diameter. One hundred milligrams radium element, with one-half millimeter of silver, one millimeter brass and two millimeters hard rubber filter, are placed in a wooden block, the whole wrapped in gauze, making a skin distance of three centimeters when applied. A total of fifteen hundred milligram hours is applied to each of the eight centimeter squares. At the end of this series, a blood count is made, and upon the findings thus obtained, additional treatment is regulated to suit the individual patient. We have not found it necessary to use radium over the bones."

Roth, N., (Vienna). "Findings After Radiotherapy in Exopthalmic Goiter." Vienna Archives of Internal Medicine, Jan. 20, 1922.

FILE UNDE
G

Exophthalmic Goiter

Tabulated details of the gas interchanges and metabolic findings in four cases of exophthalmic goiter, after systematic treatment with the roentgen rays, confirm the unmistakable benefit from the rays in recent cases. When the case is of long standing, the course long and chronic, the radiotherapy may fail to relieve. Otherwise, even when the symptoms do not show much change, the metabolic findings testify to the great transformation realized. Alimentary glycosuria could not longer be induced, in cases, but the effect of the radiotherapy was most manifest in the respiratory gas interchanges.

Pfahler, Geo. E. and Widmann, B. P.: A Case of Tuberculous ngivitis Treated With Apparent Success by Radium: *A. Jour. of entgenology,* Nov., 1922, p. 757-7.

FILE UND

G

Gingivitis, Tubercu

HISTORY.

Male, age 33. Had had pulmonary tuberculosis fifteen years before. Was in Colorado under treatment from 1915 to 1919. In the fall of 1916 an ulcer developed in the left side of the gum, running along the outer side of the teeth, and in the spring of 1920 he noticed a spot developing over the right upper canine tooth. The diagnosis of tuberculous gingivitis was made by Levy of Denver, Colorado. The electric cautery and trichloracetic acid had been used without success. Gentian violet seemed to do no good. In 1918, under Levy he received a course of tuberculin, beginning at .00000001 gm. of O. T., and going up by graded doses to .7 gm. The lung condition continued improved, but there was a local reaction in the gum when there was a tuberculin reaction, and this kept the gum irritated. A section removed and examined by Dr. Galland showed the tubercle bacillus. This was confirmed by Dr. Eugene Case, of the Department of Pathology of the Post Graduate School of Pennsylvania.

The lesions first appeared as small punctate areas scattered about the gum margins of the upper and lower canines and lateral incisors, and the left lower molars on both labial and lingual surfaces. These soon blended, forming irregular serpiginous lines extending well down over the surfaces of the gums and over a great area of the left cheek. The ulceration became progressively more definite and invading, remaining, always fairly superficial, with sharp, red, irregular borders, within which were interspersed soft granulations with pinhead spots of yellow and gray, and occasionally covered with cloudy films of dirty yellowish serum. There were much irritation and frequent pain.

TREATMENT.

The case having resisted all other forms of treatment, the application of radium was made as follows: A 10 mgm. plaque of radium covered with 1 millimeter of rubber was fixed to a wooden tongue depressor and was held firmly on as many areas as was necessary to cover all lesions. The time on each area was 20 minutes. Seven applications were made at intervals of three weeks. Special care was taken to guard against any local reaction or any destructive effect and to keep at all times within the range of a stimulating dose. The actual dose given was between 1/3 and ½ of a skin erythema dose. After each seance, the lesions grew paler, with less pain, until finally all signs of ulceration, irritation and pain had disappeared, Sept. 22, 1921. To date, there has been no evidence nor sign of recurrence.

CONCLUSION.

All others agree that these cases are most obstinate and resist all forms of treatment, such as excision, cautery, curettement, tuberculin and local medicaments. Levy believes that tuberculous ulcers of the oral cavity rarely heal, though their progress is extremely slow.

"We report this case, even though the duration of the results is short, because the results seem to be brilliant, and with the hope that others may at least try the obstinate cases."

Aikins, W. H. B.: Radium in Toxic Goitre.—*Canadian Practitioner and Review*, October, 1920, pp. 339-345.

SHEET NO. 1

FILE UNDE

G

Toxic Goitre

An experience of twelve years has convinced me of the value of radium treatment. Four years ago I reported my results with sixteen cases; in 1918 I gave a report on forty-five and at the present time I am reporting from an experience with about 100 cases of this disease.

Concerning the treatment Robert Knox makes the following statement: "In acute cases it has been found that treatment by radiations must be supplemented by (a) rest in bed, (b) dietetic treatment, and (c) treatment by drugs. The combined treatment is always more efficacious than either alone."

This practice has been followed in our treatment. Patients are urged to avoid all excitement, and to take as much rest as possible. They are also urged to eat very little meat but to take plenty of other nourishing foods, such as milk, eggs etc. The use of an ice-bag over the heart is recommended, capsules are prescribed containing quinine hydrobromate, grs. 5 t. i. d. together with ergotine, grs. 1 t. i. d. I also prescribe a mixture of strontium bromide with a bitter tonic and salines in the morning in order to secure free elimination. In many cases the above treatment alone had proved inadequate, but when employed with radium it brought about improvement in the symptoms.

In applying radium over the thyroid gland, the effect required is one of deep penetration with a minimum skin reaction. In order to attain this result, the radium must be so screened as to prevent the action of the short but powerful beta rays, and to obtain the benefit of the more penetrating gamma rays.

If the case is very far advanced, that is, if there is extreme nervousness and weakness, the patient is treated in a hospital, and the radium is left in position for long periods of time. Less severe cases are treated in the office for shorter periods of time. The first course of treatment is usually the heaviest, and varies from 150 to 360 mg. hours, according to the severity of the disease. Subsequent treatments range from 50 to 150 mg. hours, varying with the apparent progress which the disease has made.

Boggs, in a paper on X-ray treatment of Goitre, speaking of the type of Goitre which occurs during adolesence, states that this type usually recover spontaneously, that if they do not, the value of the medical treatment is questionable, and it is not desirable to resort to surgery. He says that he undertook roentgen ray treatment reluctantly, merely to secure a cosmetic effect. He says: "I was amazed to find that the treatment resulted not only in a distinct gain of weight, and bodily strength, but also in the correction of a psychic instability which has been looked on as a matter of character rather than disease. From frivolous, flighty, irresponsible girlhood, the patient passed into serene, well-ordered womanhood. In other words, they are suffering from hyperthyroidism, in so slight a degree as to give no characteristic symptoms, yet sufficiently to affect both physical and psychic strength."

It is my opinion that the effect of radium in toxic goitre of adolesence has been in some respects similar to that produced by the

X-rays, but that the former has many advantages. The superiority of radium treatment to that with X-rays is very well expressed by Dawson-Turner, when he says: "As compared with X-rays in the treatment of this condition, radium has the following advantages: (a) Absolutely constant emission of rays, and therefore exact dosage possible; (b) far greater penetration of its rays, so that the deeper parts of the gland are reached; (c) no noisy exciting apparatus, so that the treatment can be applied at the bedside without in anyway disturbing the patient. The words, 'cito, tuto, et jucunde' can fairly be applied to the radium treatment of exophthalmic goitre."

Bowing, Harry H.: The Value of Radium and X-Ray Therapy in dgkin's Disease. *Jour. of Radiology.* **Dec. 1921. pp. 20-24. Vol. No. 2.**

FILE UNDE

G

Hodgkin's Disease

"One thousand milligram hours of radium are delivered to areas of skin each 3 cm. by 4 cm. covering the involved glands. The number of areas is dependent on the amount of involvement. Fifty or 100 milligram doses of radium salt or emanation are contained either in a universal tube applicator, with silver walls 0.5 mm. thick or in a brass capsule of equal density. The radium is maintained 2.5 cm. from the skin, being filtered through the wall of the applicator and 2 mm. of lead. The duration of radiation is twenty and ten hours, respectively, for the silver and brass applicators. To maintain distance, gauze or wood (Balsa) has been used. This wood has been used satisfactorily at the Mayo Clinic for the past two years, as it is light, soft and inexpensive. A disk of lead 3 cm. by 4 cm. and 2 mm. thick is placed on top of the radium applicator to complete the package. Adhesive plaster is used to strap the parts of the block together and to fix it to the patient.

"If the top surface of the applicator should come within 2 cm. or 3 cm. of the adjacent skin surface, it is thoroughly protected with a sheet of lead 1 mm. thick. Interposed between the lead and the surface of the skin is a sheet of rubber 1 mm. thick which absorbs the soft secondaries from the lead sheet; this extends 1 cm. beyond the edges of the sheet of lead."

TREATMENT.

From 5,000 to 6,000 mg. hours of radium are applied to each right and left cervical and to supraclavicular areas, from 2,000 to 3,000 to the intraclavicular and inguinal areas and from 1,000 to 3,000 to the axillary areas. Any palpable abdominal glandular enlargement is blocked off in a manner similar to that described for the cervical area. Mild reactions such as malaise, anorexia, nausea and occasional vomiting, are usually disregarded; severe reactions are avoided. Should a severe reaction occur, the radium treatment is usually abandoned for a period of from two to three days or until the patient returns to a satisfactory condition. The fluid intake and elimination are usually encouraged and soda bicarbonate is given in dram doses three times a day.

"Two to four areas are usually radiated at one time with an interval of two or three days between treatments. A mild or intense erythema may occur after the last application or two or three weeks later. It yields readily to ordinary treatment and lasts from three to ten days. The part should be kept dry and dusted freely with a good grade of bland impalpable dusting powder. No secondary skin changes are noted, although the natural skin pigments may be increased. This does not necessarily follow an erythema."

Bowing, H. H., Rochester, Minn.: Topical Applications of Radium.
—*Amer. Jour. of Roentgenology,* Dec. 1920.

The treatment of the acute and chronic cases of Hodgkin's disease is identical. The first type is less amenable to treatment on account of its rapid clinical course. The majority of the patients are treated for cervical supraclavicular, axillary and inguinal glandular involvement with or without splenic enlargement. Roentgenograms are taken of the chest, abdomen and pelvis to ascertain the amount of involvement of the deep lymphatics.

TECHNIC.

Superficial lymphatic enlargements are mapped out and an erythema dose of radium delivered to each square inch of surface. If the nodules are discrete and small, 500 to 900 mg. hours of radium with distance screening are applied to the enlarged node. If there is splenic enlargement, six areas are mapped out over the splenic area and 50 mg. of radium in a universal round applicator screened with 2 mm. of lead at one inch distance are applied for periods of four hours each. If the roentgenograms show involvement of the thoracic, abdominal and pelvic lymphatics, deep x-ray therapy is applied in the respective areas.

Ordway, Thomas, Albany, N. Y.: Remissions in Leukemia Pro-
duced by Radium in Cases Completely Resistant to X-Ray and Benzol
reatment.—*Boston Medical Journal,* Vol. CLXXVI, pp. 490-503,
pril 5, 1917.

TREATMENT.

"The principles of cross fire as well as deep therapy are made use of in the treatment of leukemia by surface applications of radium. The technic of such radium therapy may be illustrated by the striking effect of radium when applied in the proper manner to the surface over the enlarged spleen in cases of myelogenous leukemia. For this the following details have been elaborated.

The area of the enlarged spleen is carefully and plainly marked out with skin pencil or grease paint (of red or black color) the outline being obtained by percussion and palpation. The various landmarks, such as the costal margins, anterior superior spine and crest of the ilia, the symphysis pubis and the umbilicus are marked. The patient is photographed in an erect position in both front and side views. A series of small squares 3 cm. in diameter, when the radium applicator is 2 cm. in diameter, are marked over the area of the enlarged spleen. It is important not to have the successive application areas too near together or the skin between them will be burned by the double dose. The squares thus marked out are numbered serially. A swathe of thin cotton cloth is carefully fitted to the abdomen, and the outline of the spleen, bony landmarks and small squares is traced upon it. This swathe must be smoothly and accurately fitted and kept in accurate position by means of the landmarks above mentioned, for it is left in place during each single series of treatments. The purpose of this swathe is to avoid the irritation of repeatedly applying and removing the adhesive plaster which holds the radium applicator in place, for it has been found that the area which is being, or has been radiated is particularly sensitive to injury from the repeated application and removing of adhesive plaster. Indeed, such added irritation may induce vesiculation or even superficial ulceration of the skin. Tracings of the areas and landmarks marked on the swathe are now made on tracing cloth, which serves as a chart for guidance in the following series of treatments. This affords a convenient and accurate method of recording the changes in the size of the spleen, and in avoiding injury to the overlying skin in the effort to give sufficient radiation to the underlying lesion. With the chart as a guide, the radium applicator, screened with 2 or 3 millimeters of lead, 15 to 20 thicknesses of filter paper, and wrapped in gauze, is now applied to each of the squares in the order indicated. It is necessary also to add at least as much filtration and protection to the external side of the applicator, for the patient may inadvertently rest the arm or leg on the applicator during sleep, and a severe burn may thus result. The filter paper is applied to avoid the irritating effect of the secondary rays from the lead, and the gauze adds to the comfort of the patient. If it is desired, the applicator may be rendered even more comfortable by substituting 25 to 30 layers of gauze instead of the filter paper. After from four to six weeks a second series of treatments is usually necessary, the interval between being determined by examinations of the blood and by the local condition of the skin. If the details here described are followed, however, no effect will be produced upon the skin other than very faint pigmentation after several series of radium treatments. The size of the spleen and the bony landmarks should be marked out, a new swathe fitted, and tracings made at each sitting."

DOSAGE.

When from 50 to 60 milligrams of radium element or millicuries of radium emanation are employed, evenly distributed over a surface applicator 2x2 cm. in diameter and the filtration and protection above mentioned, is used, the radium may be left in each position from 4 to 6 hours—4 hours if there are 60 milligrams, 6 hours if there are 50 milligrams and if the infiltration is 3 millimeters of lead.

With this amount of radium and the above technic, it is possible for complete remission in leukemia to occur with three series of treatments. Amounts of radium, however, as small as 25 milligrams, even when this is in the form of a tube, have reduced the spleen to normal size, and have caused the characteristic improvement in the blood and in the general condition of the patient, but the time required is longer and the series of applications more numerous.

TECHNIC.

When Radium is used, screens or filters of lead, 2 to 3 millimeters in thickness, of brass 1.2 millmeters or other heavy metals such as silver, gold or platinum, allow the penetrating hard beta and gamma rays to pass and intercept the alpha and soft beta rays which would otherwise be absorbed and cause destructive changes in the superficial tissues. As the amount of the more penetrating rays is only a small portion of the total activity, less than 5%, it is necessary in deep therapy to make exposures correspondingly long.

Bowing, H. H., Rochester, Minn.: Topical Applications of Radium.
-*Amer. Jour. of Roentgenology,* Dec. 1920.

FILE UND
G
Leukemia

More radium is given in cases of acute splenomyelogenous leukemia than in the chronic cases in order to put the patient in the chronic state as rapidly as possible. Satisfactory remissions are obtained in practically all cases.

TECHNIC.

The amount of radium used is 100 mg. in the acute cases and 50 mg. in the chronic cases. The radium is placed in a universal round applicator walled with 0.5 mm. of silver, with 2 mm. of lead as a filter at one inch distance. Six to eight areas are mapped out over the area of lymphatic or splenetic enlargement. The time of each application is four and three hours, respectively.

The treatment is repeated at weekly intervals until a series of three or four have been given. During the treatments the blood is examined. If the hemoglobin and red cells decrease, the treatment is discontinued and a six weeks rest is given. All patients are supported medicinally. Dietary measures and daily activities are also controlled.

Giffin, Herbert Z., Rochester, Minn.: Observations on the Treatment of Myelocytic Leukemia by Radium.—*Boston Medical and Surgical Journal*, CLXXVII., pp. 686-691, November 15, 1917. *Radium*, December, 1918.

FILE UN

G

Myelocytic
Leukemia

Thirty consecutive cases were treated by means of surface application of radium element over the enlarged spleen.

DOSAGE.

From 50 to 100 mg. were used. As screens, 2 mm. of lead and ½-in. of wood were used. The spleen was mapped out into squares and the radium applied over every square from two to four hours, with a total exposure, usually, of 24 or 36 hours.

In 25 cases there was definite improvement of the anemia concomitant with the improvement of the general condition.

**Janeway, Henry H.: The Use of Buried Emanation in the Treat-
ent of Malignant Tumors.—*American Journal of Roentgenology,*
uly, 1920; pp. 325-327.**

FILE UNDE
G

Lymphatic Glands

Indications for the use of buried emanation in the lymphatic glands.

In primary or metastatic tumors of the lymphatic glands, which form spherical masses, more especially those adherent to surrounding tissue but not in too intimate relation to important nerve trunks.

(See Janeway's Chart of Dosage at the Memorial Hospital, filed under D.—Dosage Emanations.)

Young, Hugh H., and Wm. Frontz, James B. Brady Urological In-
itute, Johns-Hopkins Hospital: Carcinoma of the Genito-Urinary
ract.—*Journal of Urology*, I., 505-541, December, 1917.

FILE UND
G
Genito-Urinary

TREATMENT.

Young describes in detail the treatment of carcinoma of the prostate and seminal vesicles by the three portals—the urethra, the bladder and the rectum. In twelve cases external and internal application was made. In three cases the treatment was entirely external. These three cases showed no improvement. The other 12 cases showed improvement.

TECHNIC.

In practically all of the 66 cases of cancer of the prostate referred to by Young, he used 103.7 mm. of radium element in a glass tube 24.3 mm. in length and 3.4 mm. in diameter. In all cases of prostatic carcinoma the glass tube was placed in a platinum capsule 29.5 mm. long, 6.5 mm. in diameter and 1.5 mm. thick. Young used his specially devised instruments to place this platinum tube against the diseased mass. These instruments are fully described by Dr. Young and illustrated in the Jour. American Med. Ass. April 21, 1917. This article was reprinted in Radium, June, 1917.

DOSAGE.

In some Urethra and Bladder cases five hours radiation was given. The position of the radium being changed hourly. As a rule it was found from twelve to fifteen hundred milligram hours might be given in the course of a month provided radiation at any one point did not exceed 100 milligrams during one treatment.

In trans-rectal treatments Young endeavored to give from 1500 to 2000 milligram hours in the course of six weeks or two months, using the same precautions outlined for the urethra.

In External Radium Treatments 1500 to 2000 mg. were used from 8 to 15 hours at a distance of three inches from the skin.

Pinch, A. E. Hayward, London: A Report of the Work Carried t at the Radium Institute, London.—*Annual Report for* 1918. **adium,** August, 1919.

FILE UNDE
G

Prostate

The progress of this disease is often retarded, and the distressing symptoms relieved, by appropriate radium treatment.

TREATMENT.

If the disease be confined to one lobe, forming a definite circumscribed nodule, the use of a powerful emanation tube screened with 1 mm. of silver, and buried in the growth for 24 hours is to be recommended; but when the condition is generalized, treatment is best carried out by means of an emanation tube with an initial activity of about 75 mg. screened with 1 mm. of silver, and inserted in the penultimate portion of a bi-coude catheter. This is placed in the prostatic urethra, and exposures of two hours duration given on each of four or five successive days. This is supplemented by the use of powerful screened applicators placed over the perinæum, and a 100 mg. tube screened with 2 mm. of lead and 3 mm. of rubber being placed in the rectum in contact with the base of the prostate.

The perineal and rectal exposures should be of from 24 to 30 hours duration spread over five or six days.

As these dosages are expressed in terms of Radium Bromide they must be divided by two, to obtain the proper dosage in terms of Radium Element.

Herbst, R. H.: *Journal of American Medical Association*, 1919, XXII, 1610. *Surgery, Gynecology and Obstetrics*, October, 1919, 311.

FILE UND
G

Cancer of Prostate

By the use of radium embedded in the carcinomatous prostate at six different points the author has obtained excellent clinical results. His technique consists of exposing the prostate suprapubically and placing the radium into the prostatic mass through the bladder. Six weeks to two months later the prostate is exposed perineally and the radium again placed in the gland in a similar manner. In one case reported in the article the result was all that could be desired.

Janeway, Henry H. (Memorial Hospital, N. Y. City): The Treat-
ent of Malignant Tumors of the Thymus Gland by Radium.—
nnals *of Surgery* LXXI, April 1920, pp. 460-71.

FILE UNDI
G
Tumors of Thy

Because of nine cases with primary new growths of the mediastinum treated at Memorial Hopsital or observed by him, Janeway believes "we have in radium an agent by which we may hope to produce a cure of certain malignant new growths of the thymus gland. * * * *

The favorable results obtained in the cases of our series which are still well for a year to a year and a half depend, no doubt, upon the fact that these tumors belonged to the less malignant type of lymphosarcoma.

Early diagnosis and familiarity with the clinical course of these tumors is most important. * *

In all cases x-ray examination is the one aid to diagnosis which is of the utmost importance. The location and appearance of the shadow are characteristic. It is immediately above the pericardium, higher than the usual location of that due to enlargement of the peribronichial glands. The character and location of the shadow are well shown in the radiographs of the cases * * * reported.

The radiograph is thus a valuable means of diagnosis.

DOSAGE.

In one case five applications were made of an average of 547 mc. This was screened with 3 mm. lead tubes or with 1 mm. platinum tubes applied over the sternum at a distance of 2 cm. for three hours, and to the right and left axilla for four hours. Over the axilla the distance was 5 cm.

In another case 2030 mc. were applied, filtered through 2 mm. of lead at a distance of 10 cm. for 9 hours.

In another case 1000 mc. filtered through 2 mm. of lead were applied over the sternum for 18 hours at a distance of 10 cm.

In another case 5076 mc. hours were applied, filtered through 2 mm. of lead at a distance of 4 cm., applied over the upper portion of the sternum.

CONCLUSIONS.

In conclusion it may be stated: (1) Malignant new growths, particularly lymphosarcomata of the thymus gland are of more frequent occurrence than has hitherto been believed; (2) Radium offers to patients with this disease a real relief, and in certain cases a prospect of cure; (3) Every effort should be made to treat these cases with radium during an early stage, and, in order to do this, the possibility of malignant disease of the thymus should be considered and a radiograph taken in the earliest stages of the intrathoracic affections.

Heublein, A. C.: Radium Treatment of Enlarged Thymus Glands n Infants. ***American Journal Roentgenology,*** **1920 n.s. VII, 191.**
Abstracted in *Surgery, Gynecology and Obstetrics*, August, 1920.

FILE UND
G
Thymus Gl

"Enlargement of the thymus gland is a comparatively common affection in infants and in a great many cases the direct or indirect cause of sudden death. The condition may be recognized easily from the history physical examination and roentgenogram. Up to a little more than two years ago roentgen therapy was believed to be the only effective method of treatment. At that time the author used radium on a well defined case, partly as an experiment and partly because of the observation that radium caused a more rapid diminution in the size of other pathologic overgrowths. As the result was so eminently satisfactory he has treated all other cases in the same way.

The technique followed was crossfiring with 100 mg. of radium element filtered through 0.3 mm. silver at ½-in. skin tube distance through four portals of entry, the tube being placed over the anterior aspect of the chest directly over the thymus gland. The tube was left two hours in each position making a total dosage of 800 mg. hours. However, as time is such an important factor in these serious cases, Heublein now uses 200 mg. with half the time of exposure.

In his series of 41 cases the dosage administered seemed to be sufficient to cure large as well as small thymic overgrowths in one application, and as it has been proven conclusively that the thymus has no function after birth, there need be no fear of over treatment. In none of the author's cases was there any tendency to regeneration of the gland. Possibly these results could have been obtained by a single intensive X-ray treatment, but no such results have been reported in the literature. Radium as well as the Roentgen ray is specific in its effect, but radium has the following advantages: it is portable; it gives the desired result in one treatment; its use is simple and therefore the dangerous element of fright which causes infants to resist the fixation necessary in roentgen-ray treatment and which may be the exciting cause of thymic crisis and death is eliminated. In addition the procedure is safe as the skin tube distance never varies even in the treatment of a very refractory child. Detailed reports of four cases are given."

Brayton, Howard W., and Heublein, A. C., Hartford, Conn.: Enlarged Thymus Gland.—*Boston Medical and Surgical Journal*, December 25, 1919.

FILE UNI

G

Thymus Gl

TREATMENT.

Four marks are made in the form of a rectangle over the thymic area and the nurse is instructed to allow the radium to remain 2 hours in each area. Child's head should be held in a flexed position.

DOSAGE.

100 milligrams of radium element screened with 0.5 mm. silver tube wrapped in gauze so that when applied to chest by adhesive it will be ½ inch from skin surface.

"One treatment alone suffices to effect a cure, even in the severest forms of the disease."

END RESULTS

Thirty-four cases have been treated. "In every instance there followed a prompt and lasting disappearance of all symptoms."

Pinch, A. E. Hayward, F.R.C.S., Medical Superintendent Radium nstitute, London: A Report of Work Carried Out at the Radium nstitute, London.—*Annual Report for* 1918. *Radium*, September, 1919.

FILE UNDE

G

Tuberculosis
Adenitis

In the earlier stages of this condition, before caseation has occurred and fluctuation is appreciable, radium treatment is often of great value, as it will occasion shrinking, and fibrosis of the affected glands, thus postponing or averting the employment of surgical measures.

DOSAGE.

Half-strength *applicators screened with 1 mm. of silver are employed, the total exposure being of eighteen to twenty-four hours duration, distributed over three or four days.

*In terms of radium element, this would be a quarter strength applicator.

Bowing, H. H., Rochester, Minn.: Topical Applications of Radium.
—*Amer. Jour. of Roentgenology,* Dec. 1920.

FILE UND
G

Tuberculosis
Adenitis

The simple type of tuberculous adenitis offers the best result. If supperation is present, curetting or drainage may be necessary.

The patient is supported with general hygienic and dietary measures. Hyaline or calcarious adenitis may be an end result following radiation.

TECHNIC.

An erythema dose of radium is applied to each square inch of surface covering the enlarged lymph nodes. Should the nodes be discrete and enlarged, 500 to 900 mg. hours of radium is applied. The dose is determined by the size of the nodes. The treatment is repeated every six weeks until all signs of activity have disappeared.

Henriques, A., and Menville, E. J. (New Orleans): **"Radium in reatment of Myelogenous Leukemia."** *The Journal of the A. M. A.*, n. 6, 1923, No. 1, pages 61, 62.

FILE UND

G

Myelogenous Leukemia

TECHNIQUE AND RESULTS.

Henriques and Menville report their observations in the treatment of chronic myelogenous leukemia by the surface application of radium over the spleen. One patient is in good condition eighteen months and another fifteen months since treatment began. A third patient shows a similar improvement in the past eight months. An enormous spleen, extending almost to the right lateral abdominal wall and almost to the symphysis pubis and protruding markedly both toward the front and the left, has been so reduced in size that it cannot be palpated fifteen months after treatment began. The white cells have shown a progressive decrease to the neighborhood of 20,000. The myelocytes have shown a marked reduction. The red cells in two cases increased from 2,000,000 to above 5,000,000 in about ninety days. The hemoglobin has shown a marked rise. These results were accomplished by a total dosage of from 2,200 to 2,400 mg. hours spread over four areas near the center of the spleen, through the skin, repeated monthly. The dosage employed at each sitting was from 550 to 600 mg. hours.

Pinch, A. E. Hayward, London: A Report of the Work Carried Out at the Radium Institute, London.—*Annual Report for* 1918. *Radium*, August, 1919.

FILE UND
K
Keloids

Radium rapidly produces great and permanent improvement in these conditions, especially when they have not existed for any length of time, and occur in young subjects.

TECHNIC.

The routine treatment consists in exposures of eighteen to twenty-four hours' duration with half-strength* applicators, screened with 1 mm. of silver, the series being repeated at intervals of about six weeks.

A gradual, but steady, absorption of the keloidal or fibrous tissues occurs, and there is but little, if any, surface reaction. The tenderness and itching of the keloidal tissues if present usually disappears within a fortnight of the first treatment.

*As this report is in terms of radium bromide, which is a salt containing 53.6 per cent of radium element, it is necessary to divide this strength by two to express the dosage in terms of radium element.

Yankauer, S.: Two Cases of Lung Tumor Treated Bronchoscopic-lly. *N. Y. Med. J. & Med. Rec.*, 1922, cxv, 741. Abstracted in *S. G. O.*, October, 1922, p. 276.

FILE UNDE
L
Fibroma of Lungs

"In the first case reported, the left main bronchus was occluded 2 inches from the bifurcation by a smooth rounded mass which the author diagnosed as a fibroma.

"Under local anesthesia the growth was removed piecemeal with the use of biting forceps. After the patency of the bronchus was re-established, the patient began to improve and within six weeks was free of all symptoms.

"In the second case bronchosopic examination revealed an intrabronchial mass which was granular in appearance and suggested malignancy.

TREATMENT.

"This case was treated by radium emanation placed by means of the bronchoscope, and the external application of a radium capsule. A symptomatic recovery followed and at the time this article was written (one month later) the patient appeared to be well."

Pancoast, Henry K., M.D., Philadelphia. "Modern Treatment of 'ancer of the Lip." Surgery, Gynecology, Obstetrics, May, 1922.

SHEET No. 1

FILE UND

L

Lip, Cancer o

"Our technique comprises a preliminary radiation of the area of the primary lesion and well beyond all apparent evidences of involvement by radium. Cross firing is practiced as far as is possible, and we aim to produce a severe reaction. At the same time the region of lymphatic drainage is well radiated by radium, across the face from the level of the posterior aspect of one submaxillary salivary gland to the same point on the opposite side. A full dose of x-rays is then given over each side of the neck, and as the submental and submaxillary triangles are not apt to receive their full share of the dosage because of the protection of the mandible, these areas are given an additional dose of radium. This additional dose of radium produces a severe but not dangerous reaction. If the case is being thus prepared for the surgeon, we advocate waiting for the reaction to have reached its maximum and to subside slightly before operation, in order that the maximum effect upon the lymphatic channels as well as cancer cells may be brought about. If the case does not come from the surgeon we proceed immediately to destroy the primary lesion by electrothermic coagulation, for two reasons: to obtain the added advantage of heat and to relieve the patient of the discomfort resulting from the severe radiation of the primary lesion. When a large mass of tissue is thus removed, there is some danger from secondary hemorrhage when the slough separates, and the patient is instructed how to stop the bleeding by pressure. Patients suffer little or no pain and there is only the annoyance from the sloughing process. Healing is complete in two weeks or a month. Usually there is insufficient deformity to require subsequent plastic surgery. As this procedure does not entail possible surgical trauma to cancerous tissue, we do not fear the possibility of metastasis appearing later. The radiation of the neck is repeated once or twice at subsequent periods.

In dealing with cases belonging to the second group, we have practically discontinued giving postoperative radiation, unless it is employed as an anteoperative measure as well as the results do not warrant its use. Cancer once directly traumatized by surgery without a complete removal and without previous radiation does not respond well to any form of treatment, and all too frequently upon the radiologist is laid the blame for the inefficacy of radiation.

"If we are expected to treat cases at all, we should surely be accorded the privilege of directing that treatment along such lines as our experience shows to be the most effectual. The technique we now employ in cases belonging to the second group deals with the primary lesion, lymph-channel areas, and the glandular regions in exactly the same way as in the first group, with the destruction of the primary lesion by electrothermic coagulation. If the enlarged glands do not subside or do not diminish with reasonable rapidity, we may either try radiation (radium implantation) or refer the case for block dissection, in which case we may regard the treatment already given as an anteoperative procedure. If the case is referred to us by a surgeon, the anteoperative treatment is given in the same manner as for group one cases, and the case is then referred back for excision and block dissection as soon as the reaction has subsided somewhat. It is then referred to us subsequently for postoperative treatment.

Pancoast, Henry K., M.D., Philadelphia. "Modern Treatment of Cancer of the Lip." Surgery, Gynecology, Obstetrics, May, 1922.

SHEET NO. 2

FILE UNDI

L

Lip, Cancer of

In this connection we are quite in accord with the procedure advocated by Dr. Douglas Quick of embedding emanation tubes in the operative wound at all suspicious areas, and especially where lymph channels have been cut or cancer tissue has inadvertantly or of necessity been cut into and not removed in entirety. The resulting slow radiation and intense local but not far reaching reaction from B-radiation must certainly be efficacious, and entails no danger to the flap if the emanation seeds are well covered. One must use care in giving postoperative radiation following this procedure. We have not had the opportunity of following this technique because of the lack of an emanation plant at our disposal. The frequently flaunted objection of anteoperative radiation making the operation more difficult seems to be without good foundation, according to the statements of those who employ both radiation and surgery, especially if the operation is not performed at the time of the reaction."

Janeway, Henry H.: The Use of Buried Emanation in the Treatment of Malignant Tumors.—*American Journal of Roentgenology,* July, 1920; pp. 325-327.

FILE UNDE

L

Mouth—
Cancer of

Indications for the Use of Buried Emanation in the Mouth.

It should be used:

First. In combination with surface treatment in cancers of the lip where there is deep infiltration of the substance of the lip.

Second. In cancers of the interior of the mouth not limited to the alveolar processes with the exception of the superior alveolar process in those originating in or involving by direct extension the maxillary sinus.

Third. In practically all carcinomas of the tongue and floor of the mouth.

Fourth. In cancer of the tonsil and adjacent structures.

(See Janeway's Chart of Dosage at Memorial Hospital filed under D—Dosage Emanations.)

Boggs, Russell H., M.D. (Pittsburgh, Pa.): Radium and Deep
herapy in the Treatment of Malignancy (Epithelioma or Cancer of
ıe Lip). Radium, Vol. XVIII, Nos. 4-5.

FILE UND
L

Lip, Cancer (

Primarily all epithelioma or cancer of the lower lip should be treated by radium and surgery should be reserved for correcting the deformity in cases in which the disease has caused loss of tissue before radiation was begun and for the removal of vestiges of the disease which remain in the muscle tissue after advanced cases have been radiated. The lymphatic glands in both sides of the neck should receive thorough radiation and, if any glandular involvement is present, radium should be imbedded into the palpable cancer enlargements. If epithelioma of the lip is removed surgically the routine bilateral block dissection has been followed as the orthodox procedure. Then why omit radiating these glands in both early and late cases?

The following are some of the reasons why lower lip cancer should be treated by radium:

First—More cases can be cured.

Second—The disease can be successfully removed in a large percentage of the cases without opening the lymphatics.

Third—No deformity is caused by the treatment.

Fourth—The deformity in removing a primary growth from the lip by the V-shape incision is an uncomfortable deformity, especially if a thorough operation is performed. Because of the great sacrifice of tissue, there is always a hesitancy on the part of the surgeon to remove sufficient tissue, and afterwards the contraction is often sufficient to irritate the scar, which may be the exciting cause of a prompt recurrence.

Fifth—Patients will submit to radiation and will come earlier when they realize that they can be treated successfully with radiation without operation.

For these reasons the treatment of cancer of the lip with radium deserves the foremost place.

Lain, Everett S., Oklahoma City.: A Clinical Study of Epithelioma of the Lower Lip.—*J. Am. Med. Assn.* Oct. 16, 1920, pp. 1032-34.

SHEET 1

FILE UND

L

Cancer of Lip

Cancer of the lower lip constitutes more than 2 per cent. of all deaths from cancer.

During the last 10 years we have seen 122 cases in which the diagnosis of epithelioma of the lower lip was made.

For the purposes of routine treatment we have found it convenient to classify epithelioma of the lower lip into three groups:

Class One—Epitheliomas which may begin as a seborrheic-like crust, a small recurrent vesicle or fissure, at first superficial, later becoming infiltrated and indurated, etc., and situated entirely or almost entirely on the cutaneous surface of the lower lip. These lesions are generally of slow growth and late to metastasise. If metastasis does eventually place it is usually in the smaller and more superficial of the submental, supracricoid or anterior submaxillary glands, which are easily palpable and freely accessible to treatment by any method.

Class Two—Those which are so located that one-third or more of the lesion overlaps the mucocutaneous border of the lip, though no glandular enlargement is easily palpated. * * * * These are the cases which have in the past so frequently deceived both the surgeon and radiotherapist by the rapid metastatic development within a few weeks or months after the primary growth had apparently been successfully treated or removed. We are convinced that routine attention to the lymph drainage of this class of epitheliomas, however early or localized they may at first appear, whether the treatment be surgery or radiotherapy, will result in quite a perceptible increase in the percentage of cures.

Class Three—All cases in which more than half of the malignant growth is situated on the mucous surface of the lip of many weeks or months duration, and cases which, owing to neglect or incomplete treatment, have had a marked recurrence. In this class of cases there has frequently already begun in the submental, submaxillary and perhaps the upper group of the deep cervical glands, metastases which are extremely difficult to discover and remove. In this class of cases the prognos by any known method of treatment is always unfavorable.

In our series of 122 consecutive cases of epithelioma of the lower lip, 117 were men and 5 were women, the ages ranging from 23 to 86 years, affecting mostly farmers and outdoor laborers. Treatment with the roentgen ray or radium, singly or combined was given to 107 patients. Of 72 patients treated and belonging to class 1, 95.8 per cent. are living today or have lived for more than 3 years. Of 27 patients belonging to Class 2, 70.3 per cent. lived from 1 to 9 years. In Class 3, 19 patients were examined, of whom 4 were treated. Three of these died within one year.

TREATMENT

All agree that radical removal of all possible pathologic cells is the single aim of any successful method of treatment, and that complete surgical extirpation of the primary growth, with careful dissection of all metastasizing glands has cured a high percentage of cases of epithelioma of the lower lip. However, no well informed, un-

biased physician longer doubts that just as successful work with either roentgen ray or radium, or with their combined application may be accomplished in a certain class of cases in the hands of expert radiotherapists.

When we consider the complete function of the lymph glands, is it not reasonable to suggest that a certain degree of stimulation instead of extirpation is the more scientific method of eliminating or preventing metastases in a certain class of epitheliomas, as well as in ordinary inflammatory products which they collect?

Abbe and others have repeatedly demonstrated that pathologic cells of any nature, when wandering through lymph channels, are more sensitive to an active agent, such as the roentgen ray or radium.

Georgine Luden demonstrated that the cholesterol content of the blood promotes cell multiplication, whether normal or malignant in nature. Luden further proved that radium treatment will materially reduce the cholesterol content in the blood animals. This fact had not usually been taken into account as one of the beneficent effects of radium in the treatment of cancer.

CONCLUSIONS.

Early diagnosis and treatment of the lymph drainage of the lips will materially raise the percentage of cures.

Neither surgery, radiotherapy nor any other one successful method of treatment should be used in all cases alike.

Radium and the roentgen ray, singly or combined, give the most satisfactory results in a selected class of epithelioma of the lower lip.

Janeway, H. H., M. D., New York City: Treatment of Cancer, Particularly of the Tongue, Tonsil and Rectum by Buried Emanation. —*American Journal of Roentgenology,* February, 1920. pp. 92-99.

FILE UND
L
Tonsil

Advanced carcinoma of the tonsil clinically cured by one treatment of buried emanation.

CASE HISTORY.

Chews tobacco. Two months before applying for treatment, noticed some stiffness in the neck and a sensation of a lump in the throat. Admits syphilitic infection, for which he has received salvarsan and mercury for the past two years.

The right tonsil and the adjacent portion of the anterior pillar of the fauces is destroyed on its surface and infiltrated deeply by an ulcerated, hard, neoplastic mass. The deep cervical lymphatics along the anterior border of the sternomastoid muscles are enlarged. Microscopical diagnosis:—Epidermoid carcinoma.

TREATMENT.

14.8 mc. in six minute glass tubes, embedded in the substance of the tumor tissue.

August 19, 1918—Much improved; ulcer healing; induration disappearing. The glands on the neck have disappeared. November 22, 1918—Healing complete; no evidence of disease.

New, G. B.: The Value of Radium in the Treatment of Neo-
lasms of the Nose, Throat and Mouth.—***Journal of American Med-***
cai Association, Vol. LXXI., 1918. *Radium,* October, 1919.

FILE UNDI

L

Jaws

"57 cases of cancer of the jaws and cheeks were examined at the Mayo Clinic during 1917. The cautery has been employed for several years in the treatment of such cancers in preference to resection of the jaws. In many instances the radium has been used following the cautery."

TECHNIC.

"After the patient is anesthetized with ether a mouth-gag is inserted opposite the affected side. The tongue is drawn to one side out of the way by the aid of a stomach clicker. The water cooled speculum is inserted, and all the teeth in the area involved, or those that prevent good exposure of the growth, are removed. If it is possible, the entire growth is excised from the jaw or cheek with a knife cautery, and the base is cauterized with soldering irons. If this is not possible, the irons are inserted into the tumor. The water cooled speculum prevents the burning of the lips or cheeks except in an area being treated, and it affords good exposure. A wooden tongue depressor holds the tongue out of the way and prevents it from being burned. The cautery should be used longer than really seems necessary—at least for from 20 to 45 minutes. If the growth is in the upper jaw and involves the antrum, the soldering irons are carried up into the antrum and the entire growth is gradually burned away."

"About two weeks after the cauterization most of the slough will have cleared off, and radium may be applied directly into this open area. It is directed into the ulcerating area on lead applicators, using a 50 or 100 mg. tube within a silver tube, for from 15 to 20 hours, without screening. If the growth has involved the cheek, radium is applied with screening externally over the cheek, thus cross-firing. If the growth has involved the antrum, the radium is placed in the antrum, packed there with petroleum gauze, and left in place for the period of hours required by the particular type of lesion."

"Results—Of 21 patients treated, 20 were traced; of these, 14 have been free from local recurrence from 6 to 18 months. One patient recauterized three months previously, thus far has no recurrence."

Barajas, L. Paris: Radium Treatment of Laryngeal Neoplasms —*Med. Ibera, Special Number. Surg. Gyn. and Obstet.*, **December, 1919, p. 479.**

FILE UN

L

Laryngeal Neoplasms

Cases of spreading epithelial tumors evidently undergo a process of amelioration, even to an apparent cure, after the first application of radium if the dosage is adapted to the case and the subject.

TREATMENT.

Radium should be placed in the situ, using the gamma rays and avoiding the stimulant action of the secondary rays.

DOSAGE.

Not less than 45 to 50 milligrams nor more than 75 to 80 milligrams with a maximum duration of two hours each session. These applications should be as frequent as the reaction of the organism after treatment will permit.

FILE UNDER

L

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Barajas, L. Paris: Radium Treatment of Laryngeal Neoplasms—*Med. Ibera*, Special Number. Surg. Gyn. and Obstet., December, 1919, p. 479.

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Boggs, Russell H., M. D.: **Radium Treatment of Leukoplakia.**—
xas *Medical Journal*, XXXII., pp. 224-6, November, 1916. *Radium*,
nuary, 1917.

FILE UNDER
L

Leukoplakia

TREATMENT.

The best results are obtained by the rays of low penetration, as it is not necessary to have a reaction deeper than one or two millimeters.

DOSAGE.

A tube of 25 milligrams radium element, one or two hours.

On the tongue a dose slightly larger than on the buccal membrane.

TECHNIC.

The tube is screened by 0.05 mm. of silver, several layers of gauze and a finger cot.

FILE NUMBER

L

Leukoplakia

Hogan, Russell H., M. D.: Radium Treatment of Leukoplakia.-- as Medical Journal, XXXII., pp. 224-6 November, 1916. **Radium** ary, 1917.

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Janeway, Henry H., M. D., New York: The Treatment of Cancer of the Lip by Radium.—*Journal of American Medical Association*, LXX., pp. 1051-1058, April 13, 1918. *Radium*, January, 1919.

FILE UNDE
L

Lip

Gives a brief summary of case reports of the second series of cases of epithelioma of the lip, treated during 1917 at the Memorial Hospital.

TREATMENT.

Radium emanation tubes embedded 5 mm. in molds of dental compound and filtered through the thinnest material for the most superficial lesions. A screen 0.5 mm. of silver has given uniformly successful results although it is unnecessarily heavy for the most superficial lesions.

DOSAGE.

For ordinary lesions the dose used was 60 millicurie hours per sq. centimeter with filtration through 0.5 mm. of silver and 100 millicurie hours per square centimeter, when filtered through 1 mm. of platinum.

New, G. B.: **The Use of Heat and Radium in the Treatment of Cancer of the Jaws and Cheeks.**—*Canadian Medical Weekly*, 1918, *Radium*, October, 1919.

FILE UNDE
L

Nose

METHOD OF APPLICATION.

"The radium is applied in the form of a placque or disc, over the surface of which it is spread out and held in place by varnish; or it is applied in a glass tube inside of a silver tube about 1-16 by ½ inch in size. The disc form of application is used with little or no screening, in superficial lesions, or it is screened and applied to penetrate, as in the treatment of glands of the neck. The tubes are used with screening in applications over the tumor, or they are inserted directly into the tumor. The size of the tube employed usually contains from 50 to 100 mg. of radium element. The radium emanation has not been used in any of our work."

"With all the measures at our disposal, epitheliomas of the tonsil are very difficult to clear up, but we have one patient who has been free from recurrence for nearly two years following an extensive recurrence after excision and cautery. Other patients have been markedly relieved and improved, and we feel that the possibility of improvement and help warrants the use of large doses of radium, preferably after removal of the growth. If there is a good possibility of improvement in the local growth a block dissection should be done and this followed by radium over the neck. Lupus of the pharynx is readily cleared up with radium; this seems to be the most satisfactory way of treating it."

"'Tumors of the Nose.'—Angiomas of the external nose are readily taken care of by radium, and the results are far superior to those obtained with the use of hot water injection or CO-^{2} (carbon was excised with a cautery, especially if the cartilage was involved. Later, if the condition was cured, a plastic operation was necessary to close up the opening of the nose. Such growths are now cleared up with radium with the smallest amount of deformity, if any."

Janeway, H. H.: Treatment of Cancer, Particularly of the ongue, Tonsil and Rectum by Buried Emanation.—***American Journal Roentgenology***, February, 1920, pp. 92-99.

FILE UND
L
Tongue

Gives case history of two well established cases of carcinoma of the tongue clinically cured by embedded emanation.

CASE I.

Female, 36 years, applied for treatment February 4, 1919.

Teeth in poor condition for years. Six roots had recently been removed around which there were pus pockets. In November, 1918, an ulcer developed on the right lateral surface of the tongue which was thought to be a cancer sore. Two similar ulcers developed near the tip of the tongue. These last spontaneously healed, but the first ulcer on the lateral surface of the tongue gradually increased in size. On the right lateral surface of the tongue, opposite the site of the molar teeth which have been removed, is an ulcer 2½ cm. in diameter. The base of this ulcer is raised ½ cm. and is covered with neoplastic nodules. There is only a shallow infiltration of the substance of the tongue beneath the base, although the lesion is bulky. No palpable lymph nodes. Microscopical examination: Epidermoid carcinoma.

TREATMENT.

February 4, 1919, 13.1 mcs. in three small glass tubes embedded in the substance of the ulcer.

February 6, 1919, 292 mc. in four tubes of ½ mm. silver placed on the surface of the ulcer in a mold of dental modelling compound for one hour. Following the treatment the patient became more comfortable, suffering no unpleasant reaction whatever.

February 27, 1919. No evidence whatever of any disease.

CASE II.

Male, 70 years. Has been an immoderate smoker, usually with a pipe, for years. Edentulous for the past six years. A small ulcer developed on the right border of the tongue a year and a half ago. This ulcer has gradually increased in size and become painful. On the right border of the tongue, from the middle to near the tip, is an ulcer 4½x2½ cm. in diameter. The edges are raised and hard and elevated. The infiltration of the substance of the tongue beneath the ulcer is not deep.

TREATMENT.

March 27, 1918. 305 mc. in 8 tubes of ½ mm. silver, applied to the surface of the ulcer in a mold of dental modelling compound for two hours.

March 28, 1918. 9.85 mc. in three minute glass tubes embedded in the substance of the lesion. Following the treatment the ulcer healed, but an indurated plaque remained at its site.

June 3, 1918. 8.5 mc. in five minute glass tubes embedded in the substance of the residual indurated tissue. Following this treatment all induration disappeared.

June, 1919. No evidence of disease.

New, Gordon B.: Radium in the Treatment of Lymphangioma of e Tongue.—*Journal-Lancet*, January, 1917. *Radium*, April, 1917.

FILE UNDE

L

Tongue
Lymphangioma

Gives case histories of two cases treated at the Mayo clinic.

TREATMENT.

Radium tube applied directly to tongue.

TECHNIC—First Case.

A 22 mg. tube with no screening was applied for two hours daily for 12 days.

AFTER HISTORY.

Continues to improve.

TECHNIC—Second Case.

A 28 mg. tube unscreened was applied for two hours daily for ten days.

AFTER HISTORY.

Marked improvement.

New, Gordon B.: Radium in the Treatment of Lymphangioma of the Tongue.—Journal-Lancet, January, 1917. Radium, April, 1917.

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A 28 mg. tube unscreened was applied for two hours daily for ten days.

AFTER HISTORY.

Marked improvement.

Novak, Dr. Frank A., Jr., and Cottle, Dr. Maurice H., Chicago, Ill.
ngiomata of the Larynx.” *The Eye, Ear, Nose and Throat Monthly,*
nuary, 1923, No. 12, pages 565, 566.

FILE UND
L
Angiomata of the Larynx

NOTE.

Angiomata of the larnyx, though of infrequent occurrence, judging from the literature, are of sufficient importance to warrant a perusal of the subject. Also, because of the small number in the literature, the report of a new case is herewith submitted.

SYMPTOMS

Very often the first evidence of the laryngeal angioma is hemoptysis. This usually occurs without any premonitory symptoms; it recurs soon, and may quickly endanger the life of the patient because of the ensanguination and the accompanying shock. Several fatalities from hemorrhage are on record.

Pain is very rarely a symptom, but sensory disturbances referred to the larnyx are not infrequent. These consist chiefly of parathetic sensations such as tingling, numbness, and so forth.

Coexistant occasionally with these laryngeal tumors are angiomata of other parts of the body, especially of the face, the palate, and the brain.

The growths may occur on any part of the larnyx. About 15% are in the subglottic space. They are usually single but may be multiple.

The hemangiomata vary in size from 0.2 cm. to 2.5 cm., are dark blue in color, and usually are not pulsating. They may be pedunculated, although more often they are attached by a broad base. It is difficult to make any deductions from probing the tumors. Lymphangiomata occur in about 10% of cases, are usually smoother, larger, and paler than the hemagiomata. Varices are seen as tortuous clumps of pulsating, red vessels.

TREATMENT.

With a history of sypmtoms as described above, and a satisfactory laryngeal examination, a tentative diagnosis of angioma may be made. With such a diagnosis the surgeon should choose that method of approach to the larnyx which will enable him to cope with the possibility of a severe hemorrhage. The best method, undoubtedly, for this work is suspension laryngoscopy. The tumor may be treated surgically, by electrocoagulation, by radium and X-ray, or by a combination of any of these methods.

Jackson, Chevalier, M.D. (Philadelphia): Cancer of the Larynx.
nnals *of Surgery*, January, 1923, 1-13.

SHEET NO. 1

FILE UND
L
Cancer of the Larynx

SUGGESTIONS AS TO CAUSE

Vocal Abuse as a Cause of Cancer.—It is my belief that prolonged vocal abuse can be a factor in localizing cancer in the larynx. It seems certain that this factor has been overlooked and does not show in statistics, because as a rule, vocal abuse itself is in most cases overlooked. Out of 582 cases of proven cancer of the larynx in my experience there had been undoubted vocal abuse in 376 (64.6 per cent).

That vocal abuse causes cancer is too broad an assertion. But that it is one of the commonest causes of chronic laryngitis, keratoses, papillomata and granulomata, is proven by experience; and that these conditions when perpetuated by vocal abuse and other causes can be a suitable soil for the development of cancer is, in my opinion, abundantly supported by clinical observation.

Eversion of the Ventricle as a Precancerous Condition.—In using this term the author feels a very justifable doubt as to whether or not there actually is a prolapse of the mucosa of the laryngeal ventricle. In using the term he refers to those cases in which what looks like a fold of normal mucosa can be tucked back into the ventricle with a probe.

Lues as a Precancerous Condition.—In twelve of the author's cases of cancer of the larynx there was a luetic lesion preceeding the cancerous lesion. Of these three were superficial, two fungating, two granulomatous, five ulcerative.

Keratosis and Leukoplakia of the Larynx as Precancerous Conditions.—Leukoplakia, so commonly precancerous about the mouth, I do not remember ever to have identified in the larynx, though I have seen conditions superficially resembling it. Keratosis, on the other hand, is relatively common and almost every laryngologist has seen cases in which a condition with the gross appearances of a keratosis has ultimately proven malignant.

Tonsillar Disease as a Cause of Cancer of the Larynx.—The tonsil has long been recognized as the fountain-head of a majority of the cases of disease of the throat. It has not, heretofore, been accused of causing cancer of the larynx. But we all know that a focal infection in the tonsil can be the chief etiologic factor in chronic laryngitis; and if we admit, as I think we should, that chronic laryngitis can be a precancerous condition, we must admit that a diseased tonsil can be a cause of cancer.

Benign Growths as Precancerous Conditions.—Here we enter on a subject upon which whole books have been written on the laryngeal phases alone. Sir Felix Semon, many years ago, in his exhaustive "Collective Investigations" showed conclusively that the repeated removal of a benign growth as a clinical fact had not been demonstrated to have caused cancer.

Bearing of Location of the Lesion on Precancerous Conditions.—All statistics show a great preponderance of squamous-cell carcinoma in malignant disease of the larynx.

CASES.

Treatment in Case No. 2.—Radium treatments were carried out by Dr. William S. Newcomet and had a decided effect in reducing the infiltration both in the larynx and in the neck. The lumen of the chink increased in area. The patient died of angina pectoris three and one half years after Doctor Dunn first made the diagnosis of cancer, from laryngoscopic appearances.

Treatment in Case No. 3—Tracheotomy was done under local anaesthesia. Recovery prompt and uneventful. The patient was then referred to Dr. D. Bryson Delavan and Dr. Thomas R. French for consultation. They decided to place the patient under the care of Dr. Douglas Quick for energetic treatment by radium. She is still under the treatment and is improved.

COMMENT.

Keratoses and similar overgrowths of epithelium occurring in adults are to be dealt with as potentially precancerous. The opinion of Dr. James Ewing commenting on the histology of a specimen in one of the author's cases, namely that "this is the stage in which to treat cancer, not after it gets well advanced," in my opinion expresses such a great clinical truth in such a great way, that it encourages me in making a plea before this Association for the clinical recognition of a precancerous condition. And while I realize that we cannot now definitely lay down specifications and descriptions of precise characteristics by which a precancerous condition can be identified in a given case, I think it will be a step toward the ultimate attainment of such an ideal if we begin by recognizing the fact that there exists a group of cases not already cancerous in which the malignant possibilities are so great as to justify wide removal of normal tissues surrounding the base of the lesion. The general surgical rule, applying to individuals past middle life, that benign growths exposed to irritation should be removed, probably applies to the larynx as well as to any other epithelialized structure. In regard to papillomata, however, radical surgery and radium burns from excessive dosage are to be avoided as disastrous to the voice and the lumen of the airway as well as quite unnecessary for cure. Superficial removal and avoidance of all irritation such as tobacco-laden or dusty atmosphere, vocal abuse, the cure of tonsillar infections will effect a cure with excellent vocal results. The author's case records show numerous instances in which papillomata, granulomata and oedematous polypi of the larynx have shrunken and in many instances disappeared by the sole influence of absolute silence.

Stevenson, W. C.: The Effects of Radium Treatment on War In-
uries in the Neighborhood of Nerves.—*British Medical Journal,* **1920,**
., 862. Abstracted in ***Surgery, Gynecology and Obstetrics,*** **October,**
.920.

FILE UN
N
Nerve Tis

In suitable doses radium is not injurious to nerve tissues as has been shown by the marked improvement following its use in the treatment of syringomyelia. The author presents twelve cases of war injuries near and involving nerves in which radium was used. Beneficial results were noted in all except a case of painful neuroma.

The sudden improvement in nerve function following the application of radium is probably due to the stimulation of normal functional activity in nerve tissue by the radium either by softening the scar tissue around it or by some action on the nerve cells themselves which possibly improves their nutrition. In some cases radiation appears to lessen hyperactivity in a nerve which is being irritated by scar tissue.

The improvement noted in the cases presented is evidence that radium is of value in certain types of nerve trauma and in certain stages of the repair of nerve injuries. The author's conclusions are as follows:

1. Radium treatment cannot benefit gross nerve lesions.
2. Following a nerve operation and after milder degrees of nerve trauma radium seems to aid and to hasten the return of function in a limb.
3. Radium improves the nutrition in the area supplied by injured nerves.
4. It may be of value as an aid to diagnosis.
5. It is a valuable adjunct to other forms of treatment.

Pfahler, G. E., Philadelphia: Discussion of Radium in the Treatment of Malignant Tumors of the Nose and Throat.—*Journal of American Medical Association*, **September 25, 1920; p 866.**

FILE UNDI

N

Nose

"I have patients who have had recurrent malignant disease of the maxillary sinuses some for as long as 16 years, not treated with radium but with roentgen ray. I have used radium for ten years and I believe we can accomplish a great deal, probably more than by any operative method. I believe we should use the roentgen ray with radium. We should place radium within the tumor tissue. About 8 months ago I saw a patient with a carcinoma involving the maxillary sinus and extending through the ethmoid cells back to and including the sphenoid sinus. I introduced into the maxillary sinus 50 mg. of radium in 0.5 mm of gold, which is equivalent to 1 mm of lead, surrounded by 1 mm of rubber, and left it there for twenty-four hours. I applied 50 mg. on the left side in front of the maxillary sinus, filtered through ½ mm silver, 1 mm of brass and 2.5 cm of felt, and then I placed on the outside another 50 mg. filtered in the same way. I know from experience that each one of those pieces of radium will produce an erythema in 24 hours, and that means that I have gone the limit with that amount of radium. I know also that it will kill the cancer tissue in that area, but it will not reach the disease in the ethmoid and sphenoid cells. They are too far away. To help in that area I placed radium in the posterior nares. That will reach, perhaps 2 or 3 cm of the area back of the maxillary sinus, but it will not reach the disease in the sphenoid sinuses, therefore I had to reach that area with the roentgen ray. I cross-fired from every possible angle. I saw the patient last week and so far as I can determine the disease is gone. I do not know for how long. Other patients have remained well as long as 16 years. The fact that I was able to make the disease disappear leads me to believe that by carefully treating this patient at longer and longer intervals I shall be able to control the disease and keep him well. In a number of cases of sarcoma involving the posterior nares I have succeeded in causing the disappearance of recurrent sarcoma. We can get results in many of these cases but we ought to be more careful about reporting our technic and the accuracy of our results. In that way we can help each other and get more of these patients well. In regard to electro-coagulation, I have treated hundreds of patients by this method, but we must go very carefully in cases involving the air passages and accessory sinuses. I have had some patients die of secondary hemorrhage but they all die anyway, so I have not been very enthusiastic."

Lyons, H. R.: The Use of Radium in the Treatment of Myxomatous asal Polyps. Preliminary Report *Amer. Jour. of Roent.* **July, 1921.**

FILE UND

N

Myxomatous, Nasal Polyps

"A hypothetic case illustrating the treatment by and action of radium on myxomatous nasal polyps is as follows: A patient presents himself because of constant nasal obstruction. He gives a history of having consulted a rhinologist four years before, who operated on his nose, removing large masses of jelly-like polyps. He was greatly relieved for a short time, but the obstruction returned and operation for large masses of polyps was again necessary six months after the first diagnosis was first made. He has had a total of seven operations for nasal polyps.

"Examination reveals a large mass of multiple polyps in the right middle meatus. The polyps are jelly-like and very soft; they appear "water logged." A specimen is sent to the pathologist, who reports myxomatous polyp.

"A radical operation for the removal of the polyps is performed and all the polyps are removed with a considerable amount of the adjacent tissue which is not frankly myxomatous, but which, as experience has taught, rapidly recurs as such. As soon as the reaction diminishes from three to six days post operatively, radium treatment is given and the patient is kept under observation. Soon, some very pale tissue in the middle meatus, not quite healthy in appearance, is noted. Within the next week or two this tissue becomes frankly polypous. Local treatment is continued. In case of recurrence in the remaining tissue, a section is sent to the pathologist, who reports fibromyxomatous tissue.

"A second operation, not so extensive as the first, is performed. The fibromyxomatous tumor, which resembles a fibroma malle, is removed surgically much more satisfactorily than the primary tumor. If the recurrence is extensive, the second operation is followed in from three to six days by a second radium treatment; a third treatment is rarely found to be necessary.

DOSAGE.

"In my early cases I used a 25 mg. tube of radium, screened with a silver tube of 0.5 mm. wall, covered by a sterile rubber finger cot, for one hour. Experience gradually eliminated my fear of a burn and indicated that larger doses were necessary. I now use a 50 mg. tube for two hours. Subsequent treatments are given with an interval of one week. The radium tube is put in the region of the myxomatous tissue and made secure by packing with sterile vaseline gauze. The string tied to the radium tube is attached to the cheek by a piece of adhesive tape. After two hours the pack and radium are removed. The reaction resulting from this treatment is not apparent for forty-eight hours or more. In fourteen cases treated with 25 mg. or 50 mg. for two hours no burns have occurred.

"Conclusions regarding postoperative radium treatment await the test of more time and more experience. I believe, however, that in the stubborn cases of myxomatous nasal polyps, especially those recurring after operative measures, the treatment will result in a change from a myxomatous type to a fibromyxomatous type, in which operation may be more successfully performed. Also the polyps recur less rapidly with radium treatment, and thus the interval of relief is lengthened.

Hotz, G.: Radium Treatment of Cancer of the Esophagus.
Schweizerische Medizinische Wochenschrift, Basel., May 19, 1921.
Abst. Jour. A. M. A., July 16, 1921.

FILE UN

O

Oesophagus, Ca

"Hotz extols the fine results he has obtained with radium treatment. The long and narrow applicator is swallowed to the correct depth, marked on the silk thread, and after the first eight hour sitting the esophagus often becomes permeable for fluid foods. Applicators of progressive sizes are used, and roentgen exposures supplement the radium treatment. Exploratory excision has shown in a number of cases the complete cure of the cancer, as also necropsy of one patient. Roentgenoscopy also confirms the disappearance of the tumor. As soon as the course is completed, efforts must follow to prevent cicatricial stenosis. This is accomplished by the patients swallowing a similarly shaped lead weight, nickel plated. The weights are from 4 to 10 mm. in diameter, and their weight and the active swallowing drives them slowly and harmlessly through the stenosis. The lumen was enlarged to 10 mm. in several of the cases, and the patients then refused further treatment, but these had to return later for correction of the stenosis. Each patient is given a set of these lead weights and swallows them one after the other until one sticks. In case of hemorrhage, swallowing one of these weights arrests the bleeding by direct compression.

"He has been equally successful with radium in cancer of the pharynx and tonsils and pyriform sinus, but the interval since has not been over eighteen months in any instance. The danger of after-hemorrhage with cancer in the pharynx forbids the application of this method to all patients."

Mills, R. Walter, and John S. Kimbrough. (St. Louis): Radium Treatment of Cancer of the Esophagus Under Roentgen Ray Control. *Journal of A. M. A.*, **Nov. 23, 1920. pp. 1570-76.**

FILE UNI
O
Esophagus, Can

"There is as yet no accepted criterion as to the amount of irradiation that the normal esophagus will tolerate. While this would at first thought suggest a safely minimum dose, it must be recalled that if benefit is to be derived the dose must be large enough to be definitely active throughout the entire tumor. If there is to be a prospect of a cure of the disease, it would seem dependent on a considerable dose being employed. The situation as regards cancer of the esophagus is not one that indicates temporizing.

"Requisites to the successful emplacement and continuous application of radium in cancer of the esophagus are: (1) a knowledge of the location and physical peculiarities of the tumor and the resulting stricture, especially as to location, extent, direction and the degree of stenosis; (2) a means of effective and nontraumatizing canalization of the cancerous stricture; (3) a mechanical means of maintaining the radium in direct application with the tumor; (4) a ready means of frequent observation as to the position of the radium during the period of treatment, and, (5) a careful selection as to dose, filtration and frequency of treatment."

This article further states, "esophagoscopy has heretofore been utilized by some to accomplish certain of these ends." "Esophagoscopy plus careful measurement will ascertain the location of the proximal portion of the tumor." "Sounding by olive tip bougies or gastrostomy will serve to locate its probable distal boundary and give a general idea of the luminal inequalities of the stricture." "Esophagoscopy can best determine tissue reaction after a radium treatment."

"The Roentgen ray has advantages over esophagoscopy for certain of the purposes in question.

"The use of fluoroscopy during the emplacement of the radium capsule is an effective means of aiding in the canalization of the cancerous stricture visualized by the patient's having just previously swallowed a small amount of bismuth in suspension. It is frequently an advantage to bend the wire carrier slightly at its attachment to the radium capsule so that the terminal is deflected at a slight angle. Torsion on the oral end of the wire applicator and the placing of the patient at different angles will make it possible to guide the terminal directly into the stricture. In certain cases of marked cancerous stenosis, the tip of the radium terminal may be made to engage within the proximal portion of the stricture. In certain cases of marked cancerous stenosis the tip of the radium terminal may be made to engage within the proximal portion of the stricture; but further progress is prevented by the degree of narrowing. In such instance, under careful fluoroscopic control, the tip may be left engaged in the stricture, the walls of the esophagus above being protected by the distention of the esophagus proximal to the stricture by a bismuth mixture. It will usually be found on later observations that, owing to the continuous gentle pressure exerted by the spring of the wire applicator, the radium gradually canalizes the lower levels of the stricture. In case the stricture is not visualized at any time, it may be made apparent by the simple expedient of having the patient swallow a teaspoonful or two of bismuth medium alongside the wire applicator."

Beck, Joseph C. (Chicago): **Discussing Radium in the Esophagus.**
N. Y. *Med. Journal.* **Mar 16, 1921.**

FILE UND
O
Esophagus

TECHNIC.

"Dr. Beck said that the radium he used contained twelve and a half milligrams of pure radium in the needles. The needles were of different length, the radium was in the point of the needle, twelve and a half milligrams of radium protected by the thinnest material, aluminum, silver, depending on what screening was required—the thinnest amount, one tenth millimetre, covering over this radium, was all that separated the rays of radium which were contained in this tip. These needles were sharp pointed and contained a little eyelet and through this eyelet was passed a flexible wire. That was the anchorage that you used so that it could pass down and not get lost. The esophagoscope was passed down to the growth and then by means of the forceps it was pressed into the tumor. The idea of the needles was to prevent the conditions of burning, because it was pressed into the substance of the tumor itself and never in the normal tissue, and then we get the radiations in all directions rather than from a capsule or a plaque from one side. Four of these needles were used as a rule.

"Dr. Beck said he had used it in six cases of carcinoma of the esophagus proved by the microscope. He had used it in these cases of quite progressive esophageal carcinoma in the upper and lower portion of the esophagus in four and five treatments. In the first case, where the carcinoma was in the upper portion, after five treatswallow liquids fairly comfortably, which he had not been able to do before that. Cases where the carcinomas were in the lower portion were still under treatment. One of them had had eight seances, and the other three. This was new work, and further observations were necessary. Care should be taken to allow plenty of time before stating that a cure had been effected."

oon, Dr. Merle R., (Rochester, Minn.): **"Solid Carcinoma of the**
y." *Annals of Surgery*, December, 1922, No. 6, page 775.

FILE UNDE
O
Carcinoma of the Ovary

CONCLUSIONS.

1. Solid carcinoma of the ovary may occur at any period of life from childhood to senility, the most common period being in the fourth and fifth decades.

2. The tumors are highly malignant and are more often primary than the recent literature indicates.

3. Solid carcinoma of the ovary may be bilateral, but in 66 per cent of the cases the tumor was unilateral.

4. Melanotic carcinoma is occasionally primary in the ovary.

5. Melanotic carcinoma of the ovary is highly malignant, as is the same type of tumor elsewhere.

6. The general history is similar to that of ovarian fibroma with the additional symptoms of malignancy, loss in weight, strength, and appetite, and secondary anaemia. The growth of the tumor is usually rapid.

7. Ascites cannot be considered a criterion of malignancy, as it was present in 35 per cent of the solid carcinomas and in 25 per cent of the benign fibromas.

TECHNIQUE.

8. The treatment of solid carcinoma of the ovary is surgical removal followed by Roentgen-ray and radium, if total removal of malignant tissue is impossible.

9. Metastasis and local recurrence indicate a hopeless prognosis, but palliative treatment may be given by radium and the Roentgen-ray.

Bryant, F.: Malignancy and Radiation; A Study of the Relation of the Structure of Cancer Tissue to Radiation.—***Boston Medical and Surgical Journal*, 1920—CLXXXII, 263. Abstracted in *Surgery, Gynecology and Obstetrics*, July, 1920; p. 34**

FILE UND

P

Cancer Tissu
Effect of Ra

* * * The mode of action of radiation is not yet well established but it is believed that it acts first upon the newly formed cells, at the same time exerting a destructive influence upon the fresh sources of blood supply, and that in response to nature's call for repair a proliferation of connective tissue results. If the intensity of the radiation is insufficient, the cell may be rendered dormant only temporarily, while if it is too intense the surrounding normal tissue may be broken down and nature's repair and resistant properties entirely destroyed.

It has become more and more apparent that the successful use of Radium in the treatment of cancer requires careful consideration of each type of the disease.

Some tumors require much more radiation for their destruction than others. Chondromata and tumors of osteogenetic origin react slowly. Sarcomatous growths react much more quickly than carcinomata. Basal celled epithelioma of the skin is the most easily destroyed, while epidermoid carcinoma of the tongue is the most hopeless. Next in resistance to treatment comes carcinoma of the rectum.

The condition of the tissues surrounding the tumor mass must also be carefully considered. This is influenced by age, vitality, habits, and disease. For example, persons with tuberculosis or syphilis are poor subjects for radiation, and the older the tumor the less apt it is to yield to radiation. An infection of the growth is a contra-indication for radiation. Before and after operation radiation is always to be advised. Before operation it is of value to render the growth less malignant, to cover all possible routes to metastasis and to render uninvolved lymphatics immune to invasion by bringing about a sclerosis. After operation it is indicated to destroy any scattered cells which may have escaped previous treatment. In inoperable cases radiation is recommended to prolong life, lessen pain and check hemorrhage and discharges.

As to the comparative values of radium and the roentgen ray it is safe to state that radium is admirably fitted and far superior to the roentgen ray for the treatment of growths in cavities or areas in which it can be used in needle form or emanation tubes, while the roentgen ray is better adapted for use on large surface areas, including the mass or the scar of the wound, the metastases, and the lymphatic distribution.

Ewing, James, (Prof. of Pathology, Cornell University): Influ-
nce of Radium on Cancer Tissues.—*American Journal of Roentgen-*
***logy*, September, 1918, pp. 413-14.**

FILE UNDE
P

Tissue, Influence
Radium

Radium can be relied upon to do the same thing under the same circumstances.

Radium exerts its chief effect upon the cell necleus, especially upon the dividing necleus, by means of which the growth of the cells is inhibited and they undergo a peculiar form of liquefaction, necrosis, and atrophy.

Another important principle of its action is the effect upon the underlying tissue in which the tumor is growing. It stimulates the growth of granulation tissue, which excavates the cells of the tumor and causes a remarkable exudation of various round cells, the result being a natural and complete healing process.

Schmitz, Henry (Chicago): The Action of Radium on the Ovaries.
Comments by Dr. Schmitz.—*Amer. Jour. of Roent.* July 1920, p. 335.

FILE UND
P
Ovaries

The ovaries are in most instances 8 cm. from the uterine cavity. When radium is inserted into the uterine cavity it is usually left for 12 hrs. If the erythema skin dose at 1 cm. distance is 100 mg. e. hrs., then at 8 cm. distance it would be 6400 mg. e. hrs. The sensibility of the ovary in comparison with the sensitiveness of the epithelial elements of the skin to the rays is about one-fifth of the latter. In other words, one-fifth the amount of an erythema skin dose will suffice to produce the same effect on the ovarian cells. Or, if it takes 100 mg. radium element hours to produce this effect on the skin it will take only 20 mg. radium element hours for the ovary. If we divide 6400 by 5 we obtain 1200 mg. element hours as the dosage necessary to cause degeneration of the ovarion cells. Hence the 600 mg. e. hrs. applied for uterine hemorrhages have little effect on the ovary. The cessation of the bleeding is due solely to the action of radium rays on the endometrium. Part of the endometrium receives an erythema dose, or a first degree burn, another part a second degree burn, and the portion in the immediate surroundings of the radium a third degree burn. If the endometrium is completely destroyed an amenorrhea results. If the endometrium is only partially destroyed, oligomenorrhea occurs.

Radium rays have no effect at all on the myoma if it is composed of old connective tissue. The myoma will disappear after radiation if it is chiefly made up of young, undifferentiated fibroblasts.

Bower, John O., M.D., F.A.C.S., Philadelphia, Pa. "Operating Cystoscope in Application of Radium to Cancer of the Rectum Following Colostomy." Surgery, Gynecology & Obstetrics, No. 54, No. 4, pp. 539.

FILE UN

R

Rectum,Can

"I wish to report a method of treatment of cancer of the rectum using the operating cystoscope. Three cases of cancer of the rectum have come under my observation lately in all of which an operating cystoscope and a specially devised applicator have been used to great advantage in implanting radium in the proximal portion of the growth, an effective cross-fire being obtained by inserting radium, properly screened, against the growth through the anus.

TECHNIQUE

a. A lower left rectus or inguinal colostomy is done under local or spinal anaesthesia and the bowel is opened on the third or fourth day by the use of the thermocautery.

b. On the seventh or eighth day, the lower segment is flushed clear of all debris, using a 25 F. catheter attached to a 1000 cubic centimeter reservoir; when the fluid returns clear, the cystoscope with irrigating tube attached is inserted into the bowel, the obdurator is withdrawn, the telescope inserted and the special instrument holding the radium needle is introduced into the cystoscope, and the radium needle with silk cord attached, is imbedded into the growth. The instrument is then withdrawn and as many needles as required introduced. The free ends of the braided silk are caught with a haemostat or fastened with adhesive tape to the patient's abdomen.

c. Then using a soft rubber applicator, radium, properly screened, is inserted against the lower portion of the growth through the anus.

d. The advantage of this method of cross-fire is maximum radiation due to accurate placing."

Janeway, Henry H.: The Use of Buried Emanation in the Treatment of Malignant Tumors.—*American Journal of Roentgenology*, July, 1920; pp. 325-327.

FILE UN
R

Rectum

Indications for the Use of Buried Emanation in the Rectum.

It should be used:

First. As a reinforcement to the treatment by tubes in annular growths; and

Second. Alone in growths limited to one segment of the rectal wall.

(See Janeway's Chart of Dosage at Memorial Hospital filed under D—Dosage Emanations.)

Mayo, W. J., Rochester, Minn.: **The Relation of Cancer to the Prolongation of Human Life.**—*Surgery, Gynecology and Obstetrics*, **January, 1920.**

FILE UNDE

R

Radium

Radiotherapy destroys cells for a certain distance, but cells are sterilized at a greater distance so that their reproduction is checked and connective tissue is caused to develop which acts as a barrier to the further extension of the malignant process. Radiotherapy often fails when malignant cells become attached to the walls of the three coated blood vessels from which they draw sufficient nourishment to withstand its effect.

Radium and X-Ray are more or less selective in their action. Masses and bands of scar tissue are produced which delay the advance of the growth, but make subsequent late operation difficult and often ineffective.

Radiotherapy has justly achieved a reputation in the post-operative treatment of cancer. It would appear, however, to have its greatest field of usefulness in preparing a malignant area against wound grafting during operation and its ability at least temporarily to reduce the vitality of the malignant cell. Radiotherapy whether applied as Radium, X-Ray, or heat, sickens malignant cells beyond the area of destruction. During this period of cell sickness their resistance is reduced and operation is most efficient, but operation should not be delayed after radiotherapy since the period of increased cell vulnerability is short and the connective tissue development which interferes with subsequent operation is rapid. By properly combining radiotherapy with surgery we can increase operability, lower mortality, and increased percentage of cures.

We have greatly extended the use of radium and have obtained good results in the last three years, especially in inoperable carcinoma of the large intestine and upper rectum.

Crile, Dr. G. W. (Cleveland): "Treatment of Carcinoma of Colon."
bstracted in the *Journal of the A. M. A.*, February 3, 1923, p. 357,
rom *Ohio State Medical Journal*, January, 1923.

FILE UNDE
R
Carcinoma of the Colon

Short circuiting the fecal stream to exclude the field of operation; the two stage operation; the iodoform gauze pack to prevent contamination of raw surfaces and to protect the retroperitoneal space against infection; wide resection of the cancer and use of radium and deep roentgen-ray therapy to prevent recurrences, are the leading features of the plan by which Crile and his associates have performed 389 operations on the large intestine and rectum for cancer, including a personal series of 117 operations, of which eighty-seven, including thirty-nine radical operations, have been done with only two deaths.

Cameron, William H.: A Suggested Technique: Acne Rosacea ith Telangiectasis and Erythema; Acne Rosacea with Acne Vulgaris nd Seborrhea.

FILE UNDE

S1

Acne Rosacea

TECHNIQUE

In the first type, the ¼ or ½ strength flat glazed applicator is recommended. Beta-rays may be employed but a severe reaction is to be avoided. The applicator is, therefore, covered with thin rubber only and left in place not longer than 10 to 20 minutes at each application. The second application not to be used, however, for 4 to 5 weeks after the first one. Before applying the applicator to the lesion it would be advisable to test the skin reaction of the patient by applying it for ten minutes on some non-exposed part of the body.

In the second type—Follow the technique as described for the treatment of Acne Vulgaris.

Cameron, William H.: A Suggested Technique for Acne Vulgaris.

FILE UNDE
S1
Acne Vulgaris

On account of the extensive skin area usually involved this condition should be treated by X-rays.

TECHNIQUE.

When radium is to be used divide the skin area into smaller areas and make a cast of the smaller areas with Kerrs Moulding Compound.

The size of this cast will depend on the number of 10 and 12½ milligram needles employed, as the needles should be placed ½ inch apart in all directions and ½ inch from the edges of the cast.

The cast must be thick enough to hold the radium 1/8 inch away from the skin surface. Each needle is screened with 1.0 m. m. brass.

This cast is then held in place over each area from 2 to 4 hrs., depending upon the thickness of the individual lesion.

Second applications may be made in 4 weeks if necessary.

Cameron, William H.: A Suggested Technique: Eczema; Psoriasis; Lichen Planus.

FILE UND

S1

Eczema
Psoriasis
Lichen Planus

TECHNIQUE.

In small patches of Eczema, such as may occur on the fingers, eye lid and scrotum, radium is frequently of value.

When the lesion is only slightly thickened, the quarter- or half-strength flat glazed applicator may be employed unscreened—*i. e.*, with thin rubber only—for ½ hr. The healthy surrounding skin should be protected by a window screen.

When the lesion is very much thickened, the beta-rays should be "cut out" and the applicator applied from 1 to 2 hrs.

The same treatment may be carried out, and the same rules observed, in Psoriasis and Lichen Planus. In Lichen Planus of the mucous membrane, the unscreened flat applicator may be used.

In cases requiring gamma-rays only, needles arranged as described for Acne Vulgaris may be used.

FILE UNDER
15
Eczema
Psoriasis
Lichen Planus

Cameron, William H.: A Suggested Technique: Eczema; Psoriasis; Lichen Planus.

TECHNIQUE.

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In cases requiring gamma-rays only, needles arranged as described for Acne Vulgaris may be used.

Mazzoni, L., and V. Palumbo: Treatment of Ringworm with Radium. *Policlinico, Rome.* April 4, 1921. 28, No. 14.

FILE UND

S 1

Ringworm of Sca

"Mazzoni and Palumbo have confirmed that radium treatment of the scalp causes all the hair to fall out in two weeks; depilation is complete by the eighteenth day. The hair begins to return in about four weeks after the complete fall, and soon it is as thick as before. There is no local or general disturbance from the radium treatment. They have a cap fitted to each patient, made of starched gauze, and tied under the chin with strings from in front of and behind the ears. This cap is covered with six-sided plates, each representing a field of about 6 cm. and holding 1 cg. of the radium bromid, filtered through 1 mm. of aluminum and 4 mm. of rubber tissue, left in place for twenty-four hours. With nineteen radium applicators the thirty-two or thirty-five zones can all be exposed in two sittings, each of twenty-four hours. The total of irradiation thus amounts to 7,680 up to 8,400 milligram hours. There were no failures in their 132 cases, treated to date. Some are still under treatment. The list includes favus, tinea and trichophytosis of scalp and beard, and the disease was always completely cured."

Degrais, Paris: Radium in X-Ray Burns.—*Presse Medicale,* January 14, 1920: *New York Medical Journal,* April 24, 1920.

FILE UND
S1

Burns

Degrais reports the case of an x-ray specialist who contracted dermatitis in two fingers, with complicating hyperatosis and epitheliomatous change. Amputation of the fingers had geen counselled by two x-ray men on account of the epitheliomatous condition, and the sharp pain experienced. Under radium treatment, however, the pain disappeared and the skin returned to normal. Such treatment is, therefore, to be recommended in x-ray epithelioma. Carbon dioxide snow has also given good results in some instances.

Heyerdahl, S. A.: Christiana, Norway. Actinomycosis Treated with Radium.—*Journal of American Medical Association,* Vol. 73, No. 26, December 27, 1919.

FILE UNDE
S1
Actinomyco

Gives the clinical history of 6 cases; 4 clinically cured to date; 2 greatly improved.

TREATMENT.

The swollen cheek was subjected to radium, and radium was placed within the mouth.

TECHNIC.

The glass tubes were enclosed within a lead filter 1 mm. thick, The flat applicators used within the mouth were 2 by 1 cm. square. They were used with a 0.5 mm. lead filter.

DOSAGE.

The average dosage was 8000 milligram hours but as this dosage was probably of Radium bromide, it must be divided by 2 to give the dosage in terms of Radium element.

Montgomery, Douglas W., and Culver, George D.: Eczema of the Vermilion Border of the Lips.—*Medical Record*, July 24, 1920; pp. 141-143.

FILE UND

S1

Eczema Lip

In Eczema of the Lips as it occurs in those having the exudative diathesis. In cases in which the crack has existed for a long time, is very deep and surrounded by considerable inflammatory infiltration, radium heavily screened and retained for some hours may succeed in effecting a cure where everything else fails.

In the Scurfy, Scaly Lip of the Outdoor Worker—radium employed in the same way as for cancer is the far superior treatment.

There is still another group of these dry, scaly, precancerous affections which, for lack of a better classification may be included in the eczemas. A dry, scaly line forms from side to side across the lip, situated about midway between the cutaneous border and the summit. * * * * It is in this line when roughened, that an epithelioma is apt to develop, and the recognition of this line is of importance because the epithelial degeneration of which the epithelioma represents the maximum degree, extends out along it for a very considerable distance on each side of the epithelioma proper. Therefore, any operation failing to take this into consideration is liable to be a failure as not being inclusive enough.

It is in these cases also that X-rays and radium are so beneficial, especially the latter. The employment of radium well screened secures the best results of any we have obtained. In many so treated it is impossible to tell that any previous lesion had existed.

CASE HISTORY.

Reports case of woman 37 years afflicted for years with psoriasis. Her skin, * * * was far too atonic for her years. It sagged at the jowls, under the chin and in front of the neck. She had a number of sebaceous glands in the mucous membrane of the upper lip, the significance of which is pertinent to the lesion for which she consulted us was not evident. She presented herself, January 6, 1920, with a rough, irregular, rocky, hard, adherent keratosis of the exposed red of the lower lip which had existed for several months. * * * The lesion was undoubtedly a seborrheic keratosis, and not a patch of psoriasis, and it was a lesion which if left to itself, would likely have degenerated into an epithelioma. The keratosis was removed with liquor potassae and the denuded base was found to be bright red and without any induration whatever.

TREATMENT.

She was treated with a 12.50 mg. plaque screened with a 0.4 of lead and twelve thicknesses of writing paper, held in place for five hours. Under boric acid ointment, perfect healing took place, both of the central keratosis and of the lateral wings.

COMMENT.

The point wished to be brought out is that if the central keratosis had been removed by a wedge shaped excision * * * * a cure would not have resulted, as the lateral wings would have been left to develop the same kind lesion and besides, the patient would have had a disfiguring scar.

Knox, Robert, London: Radiography and Radio-Therapeutics, Part II, 3rd Edition, 1919; p. 520.

FILE UND

S1

Eczema

Radium is used only in the chronic cases which have resisted all other forms of treatment and in which the application of Radium may start the stimulation necessary to start the healing process.

TREATMENT.

One application may lead to a marked improvement though several will be necessary in most cases. Shorter exposures will frequently give real improvement and these should be repeated at intervals of several days until a slight superficial reaction appears. When this subsides the condition gradually improves. Treatment should be repeated in a fortnight to three weeks' time and the case should be kept under observation for several months, in order to check the earliest appearance of a recurrence.

TECHNIC.

Flat applicators or tubes may be employed. The exposures varying with the filtration.

A flat applicator containing 2.7 milligrams of radium element spread over an area of 2x1 cm. will give a marked reaction in from 40 to 60 minutes. One application may lead to a marked improvement, though several will be necessary in most cases.

Shorter exposures will frequently give real improvement, and these should be repeated at intervals of several days, until a slight superficial reaction appears. When this subsides the condition gradually improves. Treatment should be repeated in a fortnight to three weeks' time and the case should be kept under observation for several months in order to check the earliest appearance of a recurrence.

Sakdabelrakesh, P.: Treatment of Eczema by Radium.—*Siamese Red Cross Medical Journal,* Bangkok. Aug., 1920. *Abst. in J. A. M. A.*, April 9, 1921, p 1046.

FILE UNDE
S1
Eczema

The type of eczema most commonly seen in Chulalongkorn Hospital is the scaly ecezema and next to it is the vesicular type. The latter sometimes yields to calamine lotion. The scaly or chronic form is the worst type and hardly yields to ordinary treatment except by radium rays.

TECHNIC.

The preparation used is a crystallized radium bromid weighing 18.95 mg. and is contained in a closed glass tube which is again contained in a sealed silver tube. When it is used, this silver tube is placed in an aluminum roller with a handle, the attendant holds the handle and passes the roller over the lesion.

RESULTS.

Of twenty-three patients ten were cured. The remainder were relieved of the itching and failed to return for further treatment.

Pinch, A. E. Hayward, F.R.C.S., Medical Superintendent Radium Institute, London: A Report of Work Carried Out at the Radium Institute, London.—*Annual Report for* 1918. *Radium*, September, 1919.

FILE UN

S1

Fordyce's Disease

Case No. 2161, M., aged 32. The patient was first seen in July, 1916, the disease being of eight months duration.

The condition affected the mucous membrane of the upper lip, at the center of which there was an oval area, 2 × 0.3 cm., of closely aggregated yellowish milium bodies. No treatment had been adopted. The patient complained of a feeling of stiffness in and occasional itching of the affected part.

TECHNIC.

A full-strength *apparatus, screened with 1/100 mm. of aluminum, was used, and an exposure of twenty-five minutes duration given. This was followed by a fairly sharp reaction, with definite crust formation, lasting for nearly three weeks.

The patient was examined three months later. The greater part of the affected area had cleared up, leaving only a single row of milium bodies, 1 cm. in length, a little to the left of the middle line. The treatment was repeated, but the exposure shortened to twenty minutes. This effectively cleared away all trace of the disease, laving a normal mucous membrane.

*With an applicator containing radium element, a half strength applicator would be used.

Kurtz, Harry A.: Radium in Keloid and Cauliflower Growths on Same Following Extensive Burns.—*Urologic and Cutaneous Review*, April, 1920.

FILE UN

S1

Keloid

CASE HISTORY.

Laborer, male, 65 years of age poured molten lead into water by mistake. The explosion threw lead over his face. Two weeks growth of beard made the lead adhere to the face and cause severe burns These healed with scar formation but always had some crusts. Five years later the lesions about the eyes began to spread to the forehead, drawing the upper lids upward and the lower lids downward, producing severe ectropion. The lesions on the right cheek and right side of the neck underwent tissue change and he developed extensive cauliflower growths. This patient denies venereal disease and was Wasserman negative. He had his leg and arm broken 25 years ago, otherwise he has been in excellent health.

TREATMENT.

From September 3, 1919, to January 4, 1920, he had in all 5000 milligram hours of radium element.

TECHNIC.

Application was made at various intervals of three to four weeks in two 25 milligram tubes and a varnish applicator of ten milligrams, properly screened.

Mackay, Hugh, M. D., Winnipeg, Canada: Radium in Psoriasis of the Nails.

FILE UNDE
SI

Nails

Ten Milligram Flat Applicator applied from 7½ to 10 milligram hours. Edge protected by a thin lead screen (1mm) and base of nail further protected with rubber.

FILE UND
S1
Ringworm Nail

Mackay, Hugh, (Winnipeg): Radium for Ringworm of Nails.

Ten milligrams flat applicator applied from 7½ to 10 milligram hours. Edge of skin protected by a thin lead screen (1 mm.) The base of the nail is further protected with rubber.

Simpson, Frank E.: Radium in the Treatment of Cancer and Various Other Diseases of the Skin.—*Journal of American Medical Association*, LXVII., November 18, 1916, pp. 1508-11. *Radium*, April, 1917.

TECHNIC.

Tubes of from 25 to 50 mg. screened with 0.5 mm. silver applied three or four times for from 15 to 20 minutes duration. This course of exposures may be repeated in a few weeks.

Stevenson, Walter C., Dublin: The Technique of the After Treatment of War Injuries.—*Archives of Radiology and Electrotherapy,* No. 225, pp. 356-362, April, 1919. *Radium,* August, 1919.

FILE UNI
S1
Scars

The largest doses are required to free scar tissue, due to the physiological organization of granulation tissue following gunshot wounds and sepsis. About half this dose is adequate to deal with the adhesion in joints and round tendons. For a purely analgesic effect on a tender scar, where the nerve endings are involved, an eighth or less of the full dose is usually sufficient.

The sequelæ of over-dose occur from three or four days to three weeks after treatment, according to the softness of the rays causing them and the amount of over-dose. The harder the rays and the less the over-dose the longer delayed is the reaction. Doses causing erythema, blistering, or superficial ulceration of the skin are sometimes necessary, but are better avoided for present purposes. They disappear quickly with a dry dressing or a simple ointment. Over-dose, causing deep burns and necrosis are very intractable, and must be avoided.

Stevenson, W. C., M. D.: The Technic of the after Treatment of War Injuries.—*Archives of Radiology and Electrotherapy*, No. 225, pp. 356-362, April, 1919. *Radium*, August, 1919.

FILE UN

S1

Superficial
Wounds

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Kelly, Dr. Howard A. (Baltimore): "Radium Treatment of czema."

FILE UNDE
S1

Eczema

TREATMENT.

Radium therapy is particularly helpful over small areas that occur on the fingers, about the nails, on the eyelids and toes. This condition is very prone to recurrence after it has once been cleared up. The dietary therapy is also very important in this type of case. The gamma rays are used. The healthy skin should be protected by a lead window screen covered with gauze or rubber. For each 2 square centimeters of disease, 100 milligram hours radiation is given at a distance of ¼ inch from the skin surface. It might be necessary to repeat this treatment in three weeks.

FILE UNDER
S1
Eczema

Kelly, Dr. Howard A. (Baltimore): "Radium Treatment of zema."

TREATMENT.

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Kelly, Dr. Howard A. (Baltimore): "Radium Treatment of Warts and Corns."

FILE UNDE

S1

Warts and Corn

TREATMENT.

This is to include the common warts seen on the hands. Both beta and gamma radiation is used here. The radium screened with 1 millimeter brass is placed directly in contact with the lesion and 50 milligram hours or one curie of radium emanation for 3 to 5 minutes is given. Corns respond to this same treatment satisfactorily.

Kelly, Dr. Howard A. (Baltimore): "Radium Treatment of Cav-
nous Angiomata."

FILE UNDE
S1
Cavernous
Angiomata

TREATMENT.

This demands considerable patience, as the result is slow in making an appearance. Gamma radiation alone is used and the erythema dose is never approached. For each 2 square centimeters of skin surface, 100 milligram hours at ¼ inch distance are given through a lead window screen. This screen should be covered with rubber or several layers of gauze. This treatment should not be repeated under three months.

Kelly, Dr. Howard A. (Baltimore): "Radium Treatment of soriasis."

FILE UND

S1

Psoriasis

TREATMENT.

The treatment should be carried up to, but not beyond the erythema dose. If there is a large patch, it should be divided into squares of 2 centimeters each and over each square 250 milligram hours are given through a lead window screen covered with rubber or gauze. Only gamma radiation is given at a distance of ¼ inch from the skin surface. The diet should be carefully regulated.

Kelly, Dr. Howard A. (Baltimore): "Radium Treatment of Lupus Vulgaris."

FILE UNDE
S1
Lupus Vulgaris

TREATMENT.

The application should be kept below the erythema dose. To each area of 2 square centimeters, 200 milligram hours should be given, using only the gamma rays at ¼ inch distance from the skin.

Kirkendall, Dr. Ben. R. (Columbus, Ohio): **Case reported by Dr. irkendall.**

FILE UND

S1

Chronic Eczem

HISTORY.

Mrs. A. R., age 43, married, housewife (country). F. H. Negative. P. H. General health, fair, nervous temperament. Not constipated. M. H. Two children. Has not passed climacetric. P. I. Began five years ago with periodical attacks of long duration, of frank eczema appearing on the dorsal surfaces of both hands and the whole surface of both wrists. The disturbance was always accompanied with intense itching and often lasted over a period of several months. All kinds of ointments, powders and local applications were used along with proper dietetic measures, with little result. Sporadic X-ray treatments were also tried.

The present attack began five weeks ago. Examination—Vaguely defined, reddened areas on the dorsal surfaces of both hands, extending onto and completely surrounding both wrists. Inflammation chronic in type accompanied with more or less scaling, moisture, crusts and considerable itching.

TREATMENT.

Fifty areas about one inch square were treated for five minutes each on three successive days, i. e. each area received a total application of fifteen minutes. Two 25 mg. tubes were placed one half inch apart beneath a one-inch square wooden block to which a handle was attached and the patient made the changes. Other than the glass and thin walled silver container, the radium was used unscreened except for one layer of thin black vulcanizing rubber.

Result—Perfect and obtained in a few weeks. There has been no recurrence up to January 10, 1923.

Lomholt, Dr. S.: "Radioactive Substances in Fluid Form." Ab-
tracted in the *Journal of the A. M. A.*, February 17th, 1923, p. 518,
rom *Hospitalstidende Copenhagen*, December 20, 1922.

FILE UNDE
S1
Psoriasis

Lomholt discusses the application of alpha rays in skin disease. In forty-four cases of psoriasis all except one showed more or less favorable influence. Small recurring patches yielded promptly to the treatment. The only drawback is the brownish discoloration that it seems to entail. He used thorium X, dissolved in alcohol, to paint the surface. Actual cure in lupus and psoriasis is rare, but more or less benefit always followed the treatment.

Daland, Ernest M., M. D. (Boston): **Radium Treatment of Kel-
ids.** *Surgery, Gynecology and Obstetrics,* **Jan., 1923, No. 1, 66-68.**

SHEET NO. 1

FILE UNI
S1
Keloids

NOTE.

Table VI.—Treatment Advised.

	Cases
No. cases examined	58
Radium advised	54
Radium advised and given	48
Radium advised and not given	6
Radium not advised	2
Radium advised after excision but not given	2
Radium following excision at another hospital	1

TREATMENT ADVISED IN OUR SERIES.

Fifty-eight cases were seen at the Huntington Hospital during the period from January, 1914, to July, 1921. Radium treatment was advised in 54 cases. One patient had a keloid on his foot, with an extensive ulcer nearby. It was thought that treatment of the ulcer was more important than radiation of the keloid. In another case the keloid was very soft, and it was of very recent origin, radium was not advised. The lesion subsequently disappeared without treatment. Excision followed by radiation, was advised in one case, but the patient failed to return for radiation until the lesion had recurred. It was then successfully radiated. Excision in another case was done at another hospital with the intention of referring him back to us for radium. The patient died of scarlet fever following the operation. Six patients failed to return for radium after it was advised. Forty-eight were treated by radium alone.

Excision of a large keloid of the chin and neck, followed by a Thiersch graft, was done by a member of our staff at another hospital. The patient was immediately referred to us for a keloid developing around the periphery. This was destroyed after several treatments and has not recurred.

METHODS OF TREATMENT.

Many different methods of treatment have been tried in the radiation of these lesions. Early in the series we were handicapped by having but a small amount of radium. Some of the early cases were treated with glass emanation tubes in 0.25 millimeter steel jackets and with 2 millimeters lead screening. In others the screening was 1 centimeter gauze, 1 centimeter air or 1 millimeter lead. In the two cases classed as "unsatisfactory" (Table VII) the screening used was 2 millimeters lead.

It has been interesting to note a fairly definite proportion between the age of a keloid and the amount of radiation required to eradicate it. It has also been noticeable that keloids in children respond more easily to treatment than do those in adults. The earliest case seen was the following:

Case 1. M. B., 10 years, of American parentage, entered the hospital for the removal of a large congenital verruca of the neck.

Excision was done on April 27, 1921. Convalescence was uneventful. On June 24, a beginning keloid was noticed along the entire scar. Radium treatments on June 24 and July 22 entirely destroyed the keloid. On the first date two emanation tubes of 35 millicuries each with 0.25 millimeter steel and 1 millimeter silver filtration were placed longitudinally and end-to-end on the keloid and allowed to remain one hour. This gave a dosage for each tube of 35 millicurie hours. On the second date a similar treatment was given over a different position of the scar. The dosage on this occasion was 40 millicurie hours for each tube. Slight erythema developed from each treatment, but there was no ulceration. There was no recurrence at the end of 6 months. This same patient had a congenital verruca of her ear. This was treated with destructive doses of radium and has been nearly destroyed. Even with destructive, ulcerating doses, there has been no tendency to form keloids in the scar of the ear.

Another case treated entirely with silver filtration (gamma radiation) follows:

Case 2. H. M., 4 years, of American parentage, burned her neck with boiling water 7 months before admission to the hospital. An extensive scar formed, with secondary keloid. Four months later an operation was performed at another hospital for the purpose of loosening up the scar. Keloidal tissue immediately formed all over the scar, increasing the contracture. She was treated eight times with the same type of filtration described in Case 1. One or two tubes were used each time, with an average dosage of 44 millicurie hours. At the end of 9 months the keloid was destroyed and the scar white. The underlying scar tissue was softened, making the contracture scarcely noticeable.

The case illustrated the close relationship between scar tissue and keloid. Scar tissue may be softened by radiation, but it does not respond to radiation as well as does pure keloid tissue. In some cases it is difficult to determine whether one is dealing entirely with scar or whether there is a keloidal element present.

We have found that it is usually necessary to use less filtration than that used in the two cases reported. Patients who have had keloids for several years require beta radiation in addition to gamma. Beta radiation produces an ulceration and destroys the pigment layer of the skin, already badly damaged. This results in a white scar which eventually becomes somewhat pink, but it never returns to the color of normal skin. In people with dark skin this makes a very noticeable scar. However, we have found that most of the patients would rather have an ulcerative treatment, and thus secure quicker results, than to have the silver filtration. It must be explained in advance that there will be some local discomfort if this type of treatment is given. The majority of our adult cases have been treated with the steel-jacketed tubes, either laid directly on the lesion or raised on 2 to 5 millimeters of gauze. The average dose per tube has been 15 millicurie hours, and the average number of treatments, six. No two cases require exactly the same dosage. In some, 10 millicurie hours produced very little reaction, while in others, 30 millicurie hours produced but slight redness. Occasionally 0.5 millimeter silver has been used where the unfiltered tube has caused excessive reaction in previous applications.

Case 3. C. B., 25 years. An American school teacher with multiple keloids on her shoulders, chest and back was referred to me by Dr. C. J. White. The condition began as acne vulgaris and had been present 10 years. On May 7, 1921, she received treatment of 92 millicurie hours with 0.25 millimeter steel 0.5 millimeter silver and 1 centimeter gauze filtration over one area. There was no result. On June 3, a dosage of 63 millicurie hours was given over the same area with no result. On July 9, a dosage of 60 millicurie hours was given with 0.25 millimeters steel and 1 centimeter gauze filtration but no silver. There was a slight softening but no erythema. A dosage of 30 millicurie hours more was given on July 20 and slight ulceration resulted. Another area was treated at intervals of about one month with 50 millicurie hours and 72 millicurie hours (0.25 millimeters steel, 0.5 millimeters silver and 0.5 centimeters gauze), without result. Three weeks later 65 millicurie hours without screening produced a deep ulceration. A third area was treated with 38 millicurie hours (unscreened) and resulted in erythema and ulceration. Other areas were then treated without filtration. It was found that the same dosage caused ulceration in some lesions and had no effect on others. This case is still under treatment. All the ulcers have healed, leaving flat, smooth scars, free from pain.

TABLE VII.—RESULTS OF RADIUM TREATMENT.

	Cases
Cases treated	48
Cases still under treatment	10
Keloid destroyed	26
Insufficient number of treatments	3
Greater amount of keloid destroyed	4
Original keloid destroyed but new one appearing nearby	2
Some keloids destroyed, others untreated	1
Unsatisfactory	2
Recurrences	0

RADIUM TREATMENT IN OTHER CLINICS.

The problem whether to treat a given keloid by absorption doses or destructive doses has been a difficult one. Wickham and Degrais recognize the need of two types of treatment. They use frequent treatments of short duration in the early lesions or those in children, and expect to cause a slight inflammatory reaction. In the old keloids in adults they use some unscreened tubes to effect a destructive action and others heavily screened to produce a "selective action."

Simpson uses "selective" doses in children and gets slight inflammatory reaction. In keloids mixed with scar tissue he uses destructive doses. Knox treats the entire keloid and the adjacent tissues to the point of superficial redness. Taft has found that X-rays are effective but that radium is better. He avoids doses causing a reaction and covers his filter with rubber or chamois to avoid telangiectases. He believes that ulcerating doses are apt to cause a recurrence. Taussig believes that all but the oldest keloids may be destroyed by radium.

Tousey advocates a dosage of 20 milligrams of radium salt, with a filter of 0.3 millimeters glass and 0.5 aluminum, for 20 minutes or more on each portion of the lesion. The applicators are covered with rubber. Pinch of the London Radium Institute uses a "half strength" applicator, screened with 1 millimeter silver. He makes three exposures of from 4 to 6 hours' duration on each of three successive days, then repeats the entire treatment every 2 months until the lesions have disappeared.

Jeanselme advises radium treatment after deep scarification of the lesion. Pfahler reports good results by excision followed by either X-ray or radium. Rostaine cites a case which recurred four times after excision but which did not recur after excision followed by radium therapy.

RESULTS.

Ten of our forty-eight cases are still under treatment. Of the others, twenty-six have had a complete destruction of their lesions. Three patients ceased treatment before a sufficient number of applications had been made. Two cases were unsatisfactory, as the keloids, of long duration, were treated with too heavy filtration. There have been no recurrences, either in the cases treated by absorption doses or in those treated by actual destruction of the lesion. Two patients developed new keloids near the old ones.

Every case treated was benefited. The first evidence of relief was the development of a certain amount of anaesthesia in the lesion. Later there was a disappearance of the itching and pulling sensation. Finally there was a softening of the scar. There was less variation from the normal color of the skin in the cases treated with absorption doses. In a few of the cases treated with ulcerating doses telangiectasis followed, but this was by no means always true.

There was no evidence to show that the tendency of a given individual to develop these lesions was influenced by the treatment of any one lesion by radium.

CONCLUSIONS.

1. It seems probable that every keloid can be destroyed by radium if a sufficient dose is used.

2. Silver filtration (1 millimeter) should be used in keloids of recent origin, in children, in people of dark complexion and in exposed areas, as the face. The dosage should be from 30 to 60 millicurie hours, according to the age of the patient.

3. Practically unfiltered tubes should be used on all other keloids. The dosage should be from 15 to 30 millicurie hours per tube. It should be explained to patient that ulceration will result from this type of treatment.

4. There is no evidence to show that the destructive doses damage the tissues so that the lesions recur. There is no lessening of the tendency of an individual to develop keloids.

Kumer, L.: The Management of Roentgen and Radium Ulcers. (Ein Beitrag zur Therapie des Rontgen und Radiumulcus), *Munchen. med. Wchnschr.*, Aug. 6, 1921, lxviii, p. 1084. *The American Journal of Roentgenology*, December, 1922, page 842.

FILE UN
S1
X-Ray and
Radium Ul

TECHNIQUE OF TREATMENT

The radical treatment of roentgen and radium ulcers is excision with subsequent sliding skin flap or skin transplantation to cover the defect. This method, however, can only be used when the ulcer is favorably located and in some cases it develops into a rather serious surgical intervention. In the clinic of Prof. Riehl, continuous water baths have been used for a long while. Sacken also reports good results with this method. The purpose of the treatment is to prevent diseased parts from contact with any irritating substance. The relief from pain is very marked. Continuous submersion in warm water hinders necrosis by permitting much better blood supply to the diseased parts. Wetterer has employed fomentations with water containing hot camomile. Bettmann reports favorable results from the use of physiological saline solution, both as a douche and as a fomentation.

Engman, Martin F., and Kimbrough, Jno. S., St. Louis: Basal Celled Cancer.—*Urologic and Cutaneous Review*, Vol. XXIII, No. 1, **1919.**

FILE UN
S2

Basal—C

Gives the clinical history and pictures of 9 cases all clinically cured.

TECHNIC.

Plaques and glass tubes of radium were used. The plagues of 10 mgs. The glass tubes of 25 mgs. The tubes were enclosed in German silver tubes 1 mm thick. These German silver tubes were enclosed in brass screens 1 mm thick, and when the combined tubes were used they were covered with 1 mm of rubber. One millimeter of gauze.

DOSAGE.

The average dosage was 133 milligram hours with extremes from 10 mg. hours to 300 milligram hours.

Stewart, Wellington T.: Radium As An Adjunct in Treatment in Some Conditions Met by the General Practitioner.—*Urologic and Cutaneous Review*, April, 1920.

FILE UN

S

Epithelioma

TECHNIC.

Ten milligrams of radium element, half strength, with no screening but thin rubber is applied direct to the lesion. The time of exposure is to be governed by the area of the lesion and the amount of induration. Three or four short applications on successive or alternate days (½ to 1 hours each) are more effective than one long exposure.

[illegible]	Stewart, Wellington T.: Radium As An Adjunct in Treatment in ma Conditions Met by the General Practitioner.—*Urologic and* *aneous Review*, April, 1920.
S2	
[illegible]	

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Pinch, A. E. Hayward, London: A Report of the Work Carried ut at the Radium Institute, London.—*Annual Report for* 1918. *adium*, August, 1919.

FILE UND

S2

Epithelioma

These growths, when of small size and situate on the glabrous skin, are best treated by short intense exposures with full-strength plates applied without screen.

DOSAGE*

The duration has to be proportioned to the thickness of the lesion, and may vary from one to three hours. A definite destructive reaction extending well beyond the margins of the tumor should be produced. With the subsidence of the reaction, a depressed white, supple scar appears at the site of the growth.

TECHNIC.

Large flat, superficially ulcerated epitheliomata without much subjacent induration respond most favorably to treatment with quarter-strength applicators, screened with 1-10 mm. of lead, an exposure of six hours' duration being given on each of three successive days, the series being repeated in six weeks' time if necessary.

*As the dosages in this report are expressed in terms of radium bromide, they must be divided by 2 to express the correct dosage in terms of radium element.

FILE No.
52

Quotations

Pinch, A. E. Hayward, London: A Report of the Work Carried Out at the Radium Institute, London.—*Annual Report for 1918.* *Radium*, August, 1919.

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TECHNIC

Large flat, superficially ulcerated epitheliomata without much subjacent induration respond most favorably to treatment with quarter-strength applicators, screened with 1·5 mm. of lead, an exposure of six hours' duration being given on each of three successive days, the series being repeated in six weeks' time if necessary.

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*As the dosages in this report are expressed in terms of radium bromide, they must be divided by 2 to express the correct dosage in terms of radium element.

Stewart, Wellington T., M. D.: Radium as an Adjunct in Treatment in Some Conditions Met by the General Practitioner.—*Urologic and Cutaneous Review,* April, 1920.

FILE U

S

Rodent Ul

"It may now be accepted as an axiom of radium therapy that rodent ulcers not exceeding 3 cm. in diameter, which have not been subjected to any previous treatment, and do not effect bone cartilage or mucous membrane, can be quickly and effectively removed by radium."

TECHNIC.

Ulcers that have progressed from a superficial condition to a more or less widespread area should be irradiated at the indurated and raised border by means of radium tubes. Twenty-five to ten milligram tubes may be used. It is not necessary to irradiate the central part of the ulcer at all, because the active progressing malignant tissue is at the border of the ulcer. The tubes can be fastened over the border and parallel to it by means of adhesive. Light screening should be used and an exposure of twelve hours over each area is given.

A flat applicator is the more advantageous type for beginning rodent ulcer. Twenty-five to ten milligrams may be used. They are fastened on a lead plate, so that when the lead applicator is bent around the lip, the tubes are parallel to the lip and directly over the epithelioma. From six to twelve hours exposure—depending on the size of the lesion. The screening is light, if the condition is ulcerative. Heavy screening is used if the growth is nodular. Irradiation of the cervical glands is necessary to complete the treatment.

FILE NO.

52

Rodent Ulcer

Stewart, Wellington T., M. D.: Radium as an Adjunct in Treatment in Some Conditions Met by the General Practitioner. - Urologic and Cutaneous Review, April, 1920.

"**It may now be accepted** as an axiom of radium therapy that rodent ulcers **not exceeding** 3 cm in diameter, which have not been **subjected to any previous** treatment, and do not affect bone, cartilage or mucous membrane, can be quickly and effectively removed by radium."

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Simmons, Channing C., M. D.: Cancer of the Skin Treated with Radium.—*Boston Medical Journal,* **October 16, 1919, Page 477.**

FILE U

S

Skin, Can

Summarizes 201 cases treated with radium. One hundred and seventy-one of these cases were such as to make a clinical cure a probability. In 124 or 72.5% of these 171 cases the growth was destroyed and the ulcer healed. In 11 cases or 6% there was only temporary improvement.

TECHNIC.

The actual method of applying the radium for treatment in small superficial tumors in accessible regions was to fasten the glass tube containing radium emanation (enclosed in a steel needle) at the top of a metal cone 1 cm. in height, the diameter of which was slightly larger than the growth. In growths about the scalp or orbit sheet lead was also used as a protection to prevent loss of hair. The average small growth usually disappeared in from two to four treatments, often in one.

DOSAGE.

The average dose was from 20 to 50 millicuries with extremes from one-half to two hours. Heavier cases were used more recently.

Simmons, Channing C., M. D.: Radium Treatment of Carcinoma f the Skin.—*Boston Medical and Surgical Journal,* Vol. XXXI., No.
, **October, 1919.**

FILE UN

S2

Skin

Two hundred and fifty-nine cases made the basis of the following technic. These cases were divided into groups as follows: Eyelids and about orbit, 52; nose, 79 cases; cheek, 71 cases; forehead, 27 cases; ear, 24 cases; miscellaneous cancer (hands, feet, etc.) 6 cases.

CASE HISTORY.

Of these 201, (77 per cent.) had previously received some form of treatment. In some the growth had been destroyed, but had recurred, while in others, treatment had had little or no effect. Many patients had drifted from one physician to another and had tried several different remedies. Many of the methods of treatment employed are well recognized and it must be borne in mind that we only saw the unsuccessful cases and have no means of judging the numbers cured.

TREATMENT.

The actual method of applying the radium for treatment varied greatly.

In the large superficial growths, the steel needles containing the radium emanations were usually laid directly on the growth in a series around it a short distance inside the edge. The bare glass tubes are also, at times, used in a similar manner, or raised up ½ cm. from the surface on a piece of gauze.

In large growths on the cheek, which have involved the bone and infiltrated the antrum, much may be accomplished by removing the tumor by operation with the knife, curette, and actual cautery. A tube of radium may be introduced into the cavity thus formed, in the gauze packing at the time of operation and left in place for from twelve to forty-eight hours, depending on the amount used.

DOSAGE.

The usual dose was from 20 to 50 millicuries, although heavier treatments have recently been used.

RESULTS.

The average small growth usually disappeared in from two to four treatments, often in one, but the resulting superficial ulcer heals slowly. After the first treatment, patients report once in two weeks for observation and further treatment as necessary.

AFTER TREATMENT.

A daily bathing once or twice with a solution of peroxide and water, equal parts, keeping the ulcers covered with white vaseline or other bland ointment on a pieece of compress cloth.

Bordier, Dr. H.: Multiple Roentgen Epitheliomas Cured by Diathermy. Abstracted in the *Journal of the A. M. A.*, from *Bulletin de l'Academie de Medecine*, Paris, Nov. 14, 1922, No. 37, page 88.

FILE UNI
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Multiple Roen
Epitheliomas

TECHNIQUE.

Bordier recommends the use of diathermy for the removal of roentgen-ray epitheliomas, describing two apparently successful cases. He was himself the subject in one.

Esguerra, A.: Plastic Substances in Radium Therapy, *Journal* e *Radiologie*, Paris, July, 1922, 6. No. 7. Abst. in *J. A. M. A.*, Sept. 0, 1922.

FILE UNI
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Technique

Esguerra, Monod and Richard give a long list of substances that have been used to hold the radium applicator in place. In their work at the Radium Institute of the University of Paris, they use a sheet of a hardened paste made of wax, liquid petrolatum and finely pulverized sawdust in the proportions of 100 parts, 100 parts and 20 parts. This thin sheet is softened in hot water and fitted like a cast to the surface to be treated. It is then removed, and the radium tubes are placed in position on the inside of the cast, as they explain in detail. The cast is then applied and held in place with adhesive plaster or bands. They enumerate a number of advantages with this "Colombia paste." It is perfectly plastic heated to 48 C: is easy to model to any region and does not soften at the temperature of the body."

Jones, Arthur C., M.D., Boise, Idaho. "Report of Radium Cases f Head and Neck." Northwest Medicine, May 1922.

FILE UNDE

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Tonsil, Cancer of

CANCER OF THE TONSIL

Case 1. Man, age 57. Comes on account of sore on left side of throat. Eight months before consulting me had a sore on left tonsil, cauterized with various caustics for a period of two months. His throat did not improve and he discontinued treatment for three months. During this time he lost considerable weight and was in almost constant pain. He consulted another doctor, who treated him for lues, in spite of the negative history and negative Wasserman. His last treatment previous to consulting me was burning with electric cautery.

Examination shows a thin, emaciated man, cook by profession; had drank heavily in early life; heavy smoker; lower teeth gone and he is wearing an ill-fitting rough plate. On his left tonsil was seen a pearly exuberant growth, extending into posterior pillar and up to base of uvula. Lower one-fourth anterior pillar covered with growth. Biopsy squamous cell carcinoma, type III. No neck glands palpable.

Fifty milligrams of radium for ten hours, screened with 1/10 mm. silver and 1 mm. of rubber held in place by a specially devised lead applicator. Seventy-five milligrams of radium over neck glands for thirty-six hours, screened with one inch porous wood and 1 mm. of lead. This treatment was repeated in ten hours and again three times at six week intervals.

At the end of the first month no active growth could be seen in tonsillar area. Some slough present and base of tongue sore from radium burn. Four months after first treatment block dissection of his neck glands, and no evidence of any metastasis. Eight months have passed, patient has gained ten pounds in weight and is following his usual vocation.

Russ, Scott S.; H. Chambers, T. H. Kellock, (London). "Immunizing Patients Against Their Own Tumor Cells." London Lancet, Feb. 1, 1922.

FILE UNDER

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Technique

The authors have been attempting to immunize patients suffering from cancer against their own cancer cells. The number of cases treated (30) is too small and the time that has elapsed too short, to form an opinion of much value. In some of the cases the disease was very advanced and in two there were probably visceral metastases at the time of treatment. Five patients with carcinoma of the breast, diagnosed by microscopic examination, were treated between November 1920 and June 1921. In all these a limited operation was performed, the primary growth only being removed. When last seen January, 1922, these patients were all in good health without evidence of recurrence. In reviewing these results it is stated that in almost all cases the stage of the disease rendered any other form of treatment inadvisable. In view of the results of some of the more recent cases, it may be possible to improve on them by adopting the treatment earlier, before dissemination of the disease has occurred.

Levin, Isaac (New York): The Relative Value of Surgery, adium and X-Rays in Cancer Therapy. Urologic and Cutaneous Re-iew. Jan., 1922. Vol. 26, No. 1.

SHEET 1

There cannot be any doubt that this last development in x-ray therapy of cancer puts the older methods into discard. The writer had to discard his old machinery and install new x-ray machines capable of delivering 280,000 volts, both in the hospitals and in his private practice. The same will have to be done by everyone who wants to do efficient work in cancer therapy. Nevertheless, a great many deductions made by the originators of these methods are too sweeping and do not bear scientific biological or clinical analysis. The methods were developed in the gynecological clinics of Freiberg and Erlangen. In both clinics an attempt was made not only to measure the quantity penetrating to a certain depth, but also the exact quantity needed to destroy a malignant tumor. A so-called carcinoma dose represents 110 per cent. of a skin dose, while a sarcoma dose represents 70 per cent. of a skin dose. Such conceptions are wrong fundamentally. Biological behavior of a cell cannot be translated into an arithmetical equation. A melanosarcoma is by far more resistant to irradiation than carcinoma, while a lymphosarcoma can be influenced by a very small fraction of the quantity needed for any other type of malignant tumors. Seitz and Wintz of Erlangen maintain that it is possible to cure carcinoma of the cervix with x-rays without the aid of any other agent. They support their view by the fact that of 24 cases so treated 23 remained well for one year. A certain number of these 24 cases were operable.

Such premature assertions do more harm than good, both to x-ray therapy as well as to cancer therapy as a whole. It may be appropriate to note a couple of facts from the work of Freiberg and Erlangen to indicate that x-ray therapy alone cannot be considered the correct treatment of cancer. Friedrich and Behme reported from Freiburg on a series of 17 cases of cervical carcinoma treated with x-ray alone. Five cases were given a so-called full carcinoma dose through the abdomen and the back. All the five patients suffered from x-ray cachexia and severe blood changes as a result of the treatment, and the cervical carcinoma was not influenced by the treatment. The other twelve cases were treated through the vagina with better local results and less general effect on the blood which was due to the small field of entry. The authors conclude that the general ill effect on the organism when large fields of entry are used influences unfavorably the local effect of the rays on the tumor. Now it stands to reason that x-ray treatment applied through the vagina must be less efficient than radium applied directly into the cervix or the endometrium. The authors attempted to bring the rays nearer to the cervix by making a deep perineal incision, but this resulted in local implantation of carcinoma. Seitz and Wintz, who, as stated above, claim to have received good immediate results with treatment of cervical carcinoma, presented in the same publication a very instructive report on the treatment of 42 cases of ovarian carcinoma. Nine cases were treated with surgery alone, ten cases with x-rays and both without any results. Twenty-three cases were operated, the main tumor masses were removed and then x-ray treatment was instituted and the result in these cases was a great deal more favorable. They conclude that ovarian carcinoma cannot be irradiated without a previous operation since the full dose produces a "Roentgencachexie." Apparently a full carcinoma dose in cervical carcinoma and the same

Levin, Isaac (New York): The Relative Value of Surgery,
adium and X-Rays in Cancer Therapy. Urologic and Cutaneous Re-
iew. Jan., 1922. Vol. 26, No. 1.

in ovarian carcinoma are different things. In this case the reason is the mass of tumor since ovarian carcinoma is even more radiosensitive than cervical carcinoma.

Yungling of the surgical clinic of Tubingen, working with the exact Erlangen methods found that x-ray therapy alone, using a full carcinoma dose, gave no results in carcinoma of larynx, lip, tongue or rectum. In other words, though the newest methods of x-ray therapy represent a great progress and must supersede all the previous methods, x-ray therapy alone is not a correct method of cancer therapy and is undoubtedly not as efficient as surgery alone or radium therapy alone."

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TREATMENT

Levin, Isaac (New York): The Relative Value of Surgery, adium and X-Rays in Cancer Therapy. Urologic and Cutaneous Re- iew. Jan., 1922. Vol. 26, No. 1.

SHEET 2

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Rockey, A. E.: (Portland, Ore.): Radium Treatment of Cancer of the Esophagus. *Jour. A. M. A.*, July 2, 1921.

PROCEDURE.

A ten yard spool of the largest size of buttonhole silk twist is threaded on a small tape and tied loosely around the patient's neck. A couple of feet may be reeled off the spool and taken into the patient's mouth, and started with a swallow of water. The thread should be fed from the spool slowly, only a few inches at a time, to avoid a tangle above the stricture. By the next day 15 or 20 feet may have been swallowed, and the thread may even project from the anus. It may now be drawn upward until it is quite taut, being held by the convolutions of the intestine. The loop of the piano wire guide is now threaded on it, and while the thread is drawn taut, and then only, may the wire guide be safely passed through the stricture on the silk thread. If the lumen is not sufficiently large, it may be increased by pushing down perforated shot and metal balls in increasing size, and then in a diminishing size, to dilate the lumen, and also permit safe withdrawal. The radium applicators are pushed into a soft rubber catheter, and this is fastened to the loop of the second piano wire by a silk stitch. This may now be pushed directly into the center of the carcinoma and the proper dose and time treatment given.

"The position of the applicator is of the greatest importance. To be efficient, the radium must be exactly in the center of the mass. At first the sense of resistance as the end of the catheter enters it, may be sufficient. Careful measurement on the first wire must then be made of the previously ascertained distance from the teeth which the second wire must be pushed to place properly the radium applicator. It may be well to confirm this by a roentgenogram and by comparing it with the barium picture of the structure. When this point is definitely ascertained, a record of the distance from the teeth to the upper end of the wire should be made for use in future treatment of the case."

Rockey, A. E.: (Portland, Ore.): **Radium Treatment of Cancer of the Esophagus.** *Jour. A. M. A.*, July 2, 1921.

SHEET 2

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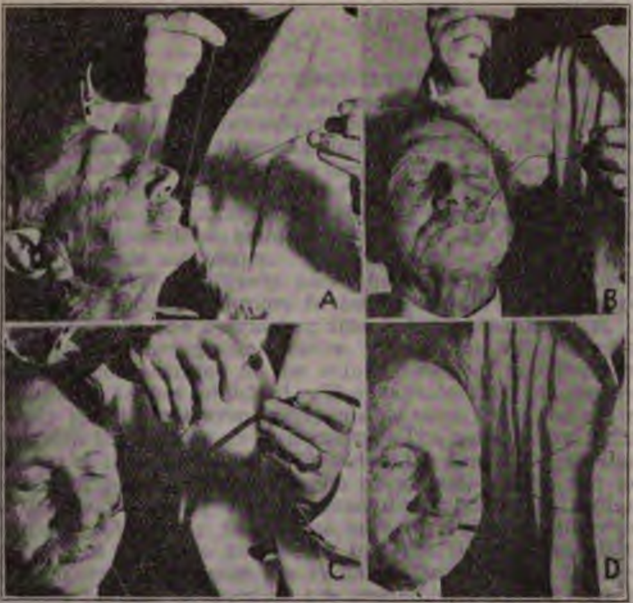
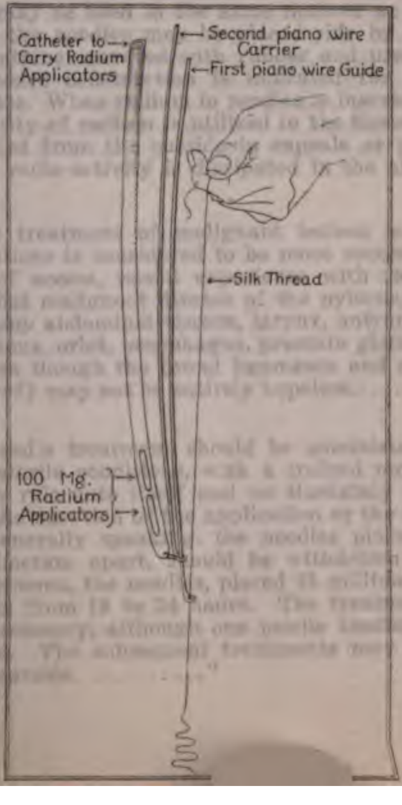
Technic

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Second piano wire Carrier
First piano wire Guide
Silk Thread
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Clark, Wm. L. (Philadelphia). **New Conceptions Relative to the Treatment of Malignant Disease with Special Reference to Radium n Needles.** *Penn. Med. Jour.* XXIV, 214-224. Jan. 1921 ***Radium,*** Vol XVII, No. 2. May, 1921.

SHEET No. 1

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Technique

"The adaptation of hollow, metallic needles, each containing some salt—preferably the sulphate—representing a known quantity of radium element, has revolutionized radium technic. (The author uses needles containing 5 to 10 milligrams). These needles are used for insertion into malignant growths and glands, or into an organ contained in the peritoneal cavity after exposure of the lesion by laparatomy—the pylorus for example. Results are obtained by this method of radium application that cannot be secured by the application of radium in capsule or plaque. This method of application is more accurate and a comparatively small quantity of radium applied in needles will produce even more favorable results than a large quantity applied from the outside or inserted in capsule form into the malignant tissue through an incision. Under the latter condition, the action is too concentrated at the point of contact and the advantage of cross-firing is not obtained. The capsule and plaque, however, have their special and even indispensable uses when radium must be applied from the outside or in a cavity. The needles are particularly efficacious in the treatment of growths too large for radium penetration from the outside by capsule or plaque, and in the more resistant forms which have been found unresponsive to radium from the outside. As many needles as necessary may be inserted 20 to 25 millimeters apart, to any depth into the tissues, thus taking advantage of concentric cross fire radiation from needle to needle. If a sufficient number of needles are available, they may be grouped together and put into a brass or other metallic filter and covered with rubber. They may be used in the same manner as the ordinary rubber capsule, or the needles may be placed side by side in a suitable flat metallic container covered with rubber and used whenever a flat plaque of standard construction is indicated for the treatment of malignant disease. When radium in needles is inserted into the tissues, the entire quantity of radium is utilized in the tissues, whereas, when radium is applied from the outside in capsule or plaque, more than one-half of the radio-activity is dissipated in the air.

"When the treatment of malignant lesions in easily accessible anatomical locations is considered to be more successful than in locations difficult of access, recent experience with radium needles has demonstrated that malignant disease of the pylorus, intestines, omentum, indeed of any abdominal viscera, larynx, antrum, splenomaxillary fossa, frontal sinus, orbit, oesophagus, prostate gland, bladder, rectum and uterus (even though the broad ligaments and other pelvic structures are involved) may not be entirely hopeless.........

"Radium needle treatment should be administered in a hospital under strictly sterile conditions, with a trained nurse in attendance. Every case is a rule unto itself and no absolutely definite guide can be given as to the duration of the application or the amount of radium to be used. Generally speaking, the needles placed in sarcomatous tissue, 20 millimeters apart, should be withdrawn in 12 hours. In the case of carcinoma, the needles, placed 25 millimeters apart, should be withdrawn in from 18 to 24 hours. The treatment is repeated in six weeks, if necessary, although one needle treatment is usually all that is required. The subsequent treatments may be given by capsule from the outside. ...."

Clark, Wm. L. (Philadelphia). **New Conceptions Relative to the Treatment of Malignant Disease with Special Reference to Radium a Needles.** *Penn. Med. Jour.* XXIV, 214-224. Jan. 1921 *Radium*, Vol XVII, No. 2. May, 1921.

SHEET NO. 2

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Technique

"Encouraging results have been accomplished during the past two years since radium needles have been shown to be of practical utility in the treatment of malignant lesions, even with almost no guide as to filtration, time of exposure to the rays, and technic generally; yet it is the author's conviction that this method of treatment is only in its infancy and that the future will show radium, with better technic and greater knowledge concerning it, to be of far greater potency than is realized at the present time. It is not to be understood that all cases of malignant disease uniformly react favorably to radium, for it has been observed that some cases respond better than others. The impression from present experience is that, if a malignant lesion does not respond to three or at most four radium treatments, then the lesion cannot be favorably influenced by further treatments.

"One must guard against over-exposing patients to radium. If a malignant lesion is over-exposed, great devitalization and sloughing of the normal tissue beyond the malignant growth is likely to result. The ulcer shows little tendency to heal, and this condition may be so serious as to be almost as undesirable as the malignant lesion itself. Beginners in the use of radium are therefore warned to underexpose patients rather than overexpose them to the powerful radium rays, until an exact technic of application has been acquired. It seems appropriate at this time to sound a note of warning to physicians and attendants to guard themselves against handling radium carelessly. Familiarity breeds contempt and it is advised that eternal vigilance be practiced, else distressing, permanent, third degree burns. keratoses, and even cancer of the exposed parts, may result from the constant irritation of radium rays. Distance is the best safeguard and it should be the invariable practice to handle radium applicators of any description with forceps at least four or six inches in length.

Boggs, Russell H., M.D. (Pittsburgh, Pa.): Radium and Deep herapy in the Treatment of Malignancy (Carcinoma of Tongue). adium, Vol. XVIII, Nos. 4-5.

FILE UND
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Cancer of To

Carcinoma of the tongue is one of the most difficult of the mouth lesions to treat and the most difficult to obtain complete retrogression, because even in the early cases the glands have metastasized, minute processes have invaded muscle substance for a considerable depth and if the growth is situated in the posterior part of the tongue there is an early invasion of the tissue towards the tonsil. Therefore, the groove between the tongue and tonsil should always receive radiation. The method that should give the best results is extensive surface radiation, together with intensive radiation of the lymphatics, burying radium needles two or four weeks later in the posterior half of the tongue and in the tissue in front of the tonsil and in the tonsil on the affected side. This should be followed in some cases by electric-coagulation.

In the treatment of the lymphatics radiation should be as thorough as possible, and even then, like a thorough dissection, it often is not radical enough. If an operation is performed it should be preceded by radiation because raying should destroy the small deposits in the glands which are not palpable or at least check proliferating cancer cells. By waiting five or six weeks after raying the primary growth, the cancer cells are far on toward retrogression. Besides, there is not the same danger of spreading cancer cells. It is claimed that the lymph nodes do for a time check cancer cells. While radium has many shortcoming in the treatment of cancer of the tongue, it is a step in advance, and with improved technic more should be accomplished in the future.

Boggs, Russell H., M.D. (Pittsburgh, Pa.): Radium and Deep ierapy in the Treatment of Malignancy (Sarcoma of the Tonsil and iroat). Radium, Vol. XVIII, Nos. 4-5.

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Cancer of Tonsi

"Sarcoma of the tonsil and throat can nearly always be cured clinically by radiation within a comparatively short time, but within a year or two a recurrence takes place in nearly all cases. Formerly we did not seem to realize the extreme malignancy of sarcoma and did not treat at sufficient distance from the primary lesions. We were satisfied when the lesion, filling up the greater part of the throat, responded and there was no clinical evidence of sarcoma in the tissue. In treating sarcoma of the tonsils and throat, the glands of both sides of the neck, as well as the mediastinum, should receive deep radiation. Experience taught us that if treatment is stopped after local treatment is given, we will nearly always have a recurrence. It remains to be seen what our results are going to be by more thorough radiation and a follow-up system of these cases."

Quick, Douglas. **(New York City, Memorial Hospital): Treat-**
ent of Carcinoma of the Tongue. ***Annals of Surgery,*** **June, 1921.**
). 716-723.

FILE UNI

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Tongue,
Carcinoma of

"In the treatment of the primary lesion, we feel very strongly that surgery occupies no place, and that this part of the disease belongs entirely to the radium field.

"While we have not discarded surface applications of radium in tongue cancer, we feel that its use in this way is confined to the treatment of certain very superficial growths, such as some of those beginning in leucoplakic areas, to the cases of basal-cell carcinoma which we very occasionally meet with. The bulk of our treatment rests entirely upon the use of buried emanation. For this purpose we use fine glass capillary tubes about three millimeters in length and 0.3 millimeters in diameter, each containing about one millicurie of radium emanation. I specify one millicurie, or slightly less, as being the most satisfactory strength to use at present. In our earlier work we used tubes of two, three and four millicuries, but found they produced too much necrosis of tissue.

"These weak tubes are buried uniformly throughout the growth by means of fine trocar needles and left in situ. In order to make this as painless as possible, the lingual nerve is injected with 1 per cent novocaine, or, if the lesion be far back on the tongue, infiltration with novocaine is used. The dose of radium applied in this way depends, of course, upon the size of the lesion, although the average is probably from six to fifteen millicuries. The shape of the lesion also has something to do with the amount necessary, since it is quite evident that a bulky spherical lesion requires relatively less than one of the elongated type extending for a considerable distance along the lateral border of the tongue. Uniformity of distribution and accuracy of approximation throughout the growth are the all important factors.

"While the use of radium emanation in this manner is, in many respects, comparable to the burying of steel or gold needles containing element, still there are certain features of difference.

"In our opinion the primary lesion in cancer of the tongue should be managed entirely by the use of radium. The use of buried emanation in weak tubes uniformly distributed throughout the growth is by far the method of choice in applying the radium.

"The cervical nodes should be treated conservatively:

"First, by external radiation where the neck is free from palpable involvement, and then, should metastases appear, the treatment of these should be by external radiation, followed by a complete neck dissection under local anaesthesia, coupled with the use of radium emanation in very weak tubes buried throughout the wound."

**Simpson, C. Augustus: (Washington, D. C.): Atrophy of Lym-
hatics and Tonsilar Tissue by Radium and X-Ray.** ***Jour. of Radiol-
ry*** **II. No. 8, pp. 35-58, September, 1921.**

FILE UND

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Tonsils

TECHNIC.

"I am using a flat dematological 30 mg. double strength radium applicator, covered only with a single layer of sterile rubber tissue. Swabbing the throat and tonsil with a two per cent. novocain solution will actually eliminate any gagging.

"A convenient handle is supplied with the applicator which enables the patient to hold the unscreened radium directly on the tonsil for an hour. With this original technique it is perfectly remarkable how quickly the tonsil begins to shrink and show other atrophic changes. A mild reaction which turns white is to be seen where the radium has been held. This slight irritation of the tonsil disappears in two or three days.

"In one patient with a temperature of one hundred and one degrees, exudate in the crypts of the enlarged protruding and inflamed tonsils, cervical glands of the neck the size of half an orange, associated with malaise, loss of appetite, the picture was changed in one week and after a single treatment. After two weeks, the tonsil was the only part of the entire naso-pharyngeal field that did not share in the very acute red, inflamed condition that involved every other part of the porterior nares and pharynx. The enlarged glands had disappeared in three weeks, and only a small part of the tonsil was to be seen when the anterior pillar was pulled to one side. On the opposite side, not complicated by enlarged cervical glands, the enlarged protruding tonsil had entirely disappeared after a single exposure of x-ray and radium.

"By using the unscreened radium applicator on the surface of the tonsil, combined with three points Hampson x-ray through three mm. aluminum pastile on skin and covered with two layers of chamois skin externally, I get a cross fire of radium and x-rays which is concentrated and centered on the tonsil itself."

Wells, Walter A. (Washington, D. C.): **On the Practicability of fecting a Complete Atrophy of the Tonsils by the Use of Radium.** *outhern Med. Jour.* XIV. 907-909. Nov. 1921. *Radium* Dec., 1921.

FILE UNI

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Tonsils

"It seemed to the writer that radium might possess a decided advantage over the roentgen ray in that it could be brought directly to the seat of trouble instead of being obliged to pass through a mass of healthy tissue, which lessens the activity of the rays and which incidentally might be unfavorably influenced by them.

"In my case the radium enclosed in the hollow of a specially adapted needle is imbedded in the center of the substance of the tonsil for a length of time which varies according to circumstances. The rays pass through a screen 0.15 mm. in thickness, consisting chiefly of an alloy of platinum and iridium (30 per cent.)

"The users of x-ray have pointed to the fact that after exposure they have noted a disappearance of the small disseminated deposits of lymphoid tissue often seen in the pharynx, and have claimed this is an advantage. But this view has no support in laryngological experience, for these little lymphoid deposits are never the seat of pathologic exudate and their removal has never been found necessary to eliminate infection. If sometimes they are seen to appear or become larger after radical tonsillectomies, it is a question if this is not to be regarded as compensatory and protective rather than a pathologic reaction.

"In our opinion, therefore, the shot gun action of the x-ray charge is a real objection rather than an advantage and the stray shots which go wide of the real mark not only do no good, but may do harm to perfectly innocent bystanders."

Robinson, Carl F., M.D. (Barre, Vermont): **Radium Treatment of** onsils and Adenoids.

—By Carl F. Robinson, M. D., Barre, Vermont.

SHEET NO. 1

FILE UNI

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Tonsils, Enlarg

"My first cases consisted of those patients exhibiting chronically enlarged tonsils with histories of repeated tonsillar abscesses. Then we tried a few who presented symptoms of neuritis, rheumatism, etc. All were adults.

"The technic used was: 50 milligrams of radium element to each tonsil. This was screened with 0.5 mm. silver, 1 mm. brass, 1 mm. rubber tubing and one-half inch of gauze—the latter to give distance. This pack was placed over each tonsil for twelve hours.

"Later I tried out a few children, and have established a dosage of 10 hours for the 15-year-old, 8 hours for the 12-year-old, 6 hours for the 10-year-old and 5 hours to each tonsil for children under that age. The treatment can be repeated in six weeks if necessary, giving one-half of the first dosage in the second application. Those who are so fortunate as to have an emanation plant can, by placing the "seeds" directly into the tonsil, save time and produce the result with a much less dosage.

"The results of treatment are seen in six weeks' time and consist of a markedly reduced tonsil, due to atrophy or absorption of the immature lymphatic cells in the follicle, thus lessening the depth, and resulting in a distortion of the crypt, at the same time causing an eversion and evacuation of the crypt contents,—according to Witherbee of the Rockefeller Institute of New York City.

"Another effect of radiation is noticed. This is the action of the rays on other pathological conditions of the throat. The adenoid, the infra-tonsillar nodule, the lingual tonsil and the chain of lymphatics which extends well up the lateral walls of the throat to the Eustachian tube, are frequently more or less diseased, exhibiting marked hypertrophy and infected crypts, consequently we feel that the clearing up of these areas is as important as the clearing up of the tonsil. We remove, surgically, the tonsils with the hope of curing neuritis or an arthritis, only to find that the disease progressed as before the operation. The dissection of these individual infected crypts is impractical and tedious, therefore surgery does not remove all points of infection. The advantage of radiation over operation is therefore obvious. Many a nervous or timid patient will not, in spite of the best advice, submit to operation and prefer to carry their infection. Because of the time factor and expense connected with x-ray treatment, it is for out-of-town patients not always possible I feel, then, that the addition of radium gives the physician an additional therapeutic agent, and from a humanitarian standpoint (a point of fact the physician is liable to forget) a wonderful servant.

"In conclusion I again call your attention to the following points wherein I believe radium has the advantage over either surgery or x-ray. I wish it understood, however, that until results from a large number of men are reported and tabulated x-ray or radium should be reserved for selected cases.

1. One application only is usually required. It therefore saves time for the patient.

2. The method advocated is safe, painless, noiseless, easily applied.

3. It clears up all the infected points, being in this manner superior to the surgical removal of the tonsils and adenoids.

4. It allows the timid, weak and nervous patients and those who have conditions contra-indicating operation, to receive rational treatment.

5. No local or general anesthetic required; danger of hemorrhage or lung abscess entirely absent.

Stacy, Leda J.: Gives American Radium Society Form for Reorting Radium Cases. Letter of Oct. 30, 1920.

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Reporting Cases

At the meeting of the American Radium Society in New Orleans last April, the Research Committee submitted a form for recording the history, examination and detailed outline of treatment, in cases having radium application. The committee felt that it was necessary to establish as nearly a uniform method of recording cases as possible.

The following is the form approved by the Radium Society:

SCHEDULE SUBMITTED BY RESEARCH COMMITTEE OF THE AMERICAN RADIUM ASSOCIATION

1. Keeping records of all cases treated.
   First page—Short history, diagnosis, grouping based on physical findings.
   Second page—

Case No.	Date of Treat.	Am't. of El. or Emanation. Screening	Duration of Treatment	Total mg. hours or mc. hours

2. Gouping of Cases—
   - A. Operable.
   - B. Borderline or doubtfully operable.
   - C. Inoperable.
   - D. Advanced and hopeless.
   - E. Recurrences—(Local, Regional).
3. Estimation of E. S. D. of each tube of radium. The E. S. D. should be the standard of comparison of sensitiveness of the various elementary and diseased tissues.
4. The methods of screening and protection of adjacent healthy tissues—a. distance; b. material used.
5. The importance of postmortem examinations and serial sections of organs in toto, this being the only means to determine the correctness of the technic and the actual permeability of the rays, thereby establishing the actual therapeutic value of radium rays.
6. The re-examination of all patients at stated intervals and careful reording of subjective and physical findings at each examination (both visible and palpable).

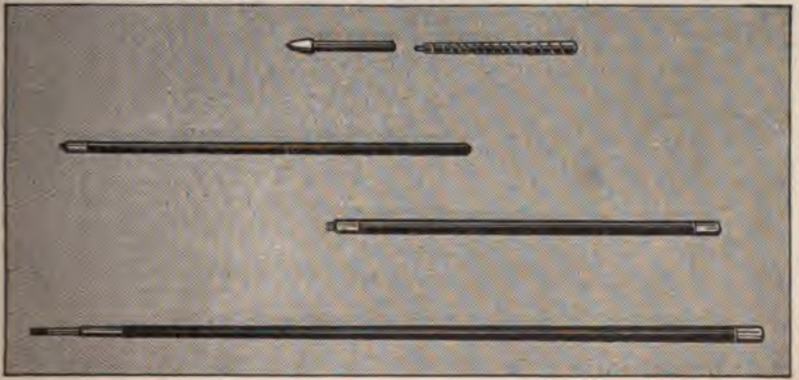
Hanford, E. W.: Oesophageal Radium Applicator.—*Surgery, Gynecology and Obstetrics*, July, 1920, p. 84.

The application of radium to any part of the oesophagus is at best trying and difficult. The device shown in the photograph is the result of suggestions from James N. Neff. With this instrument radium can be applied to a carcinomatous oesophogeal stricture with less trouble than has been our experience in using any other form of applicator.

The shaft of the instrument of whalebone is made in three sections so that it may be accommodated to any position in the canal. To the section of spiral wire, the silver tube containing the glass radium capsule is attached. The end of this tube is shaped like an olive. In the side of this olivary body is a small hole which connects with a narrow channel extending to the apex of the olivary body through which the string the patient has swallowed can be passed.

When ready to make the application the slack of the string in the oesophagus is taken up and the end passed through the olivary body, and held. The operator passes the applicator down the oesophagus, and the string acts as a guide. It is best to give the patient a barium meal before application so that the passage of the applicator can be observed through the fluoroscope. When the radium tube is in position, the end of the whalebone at the mouth is passed through a hole in a metal mouthpiece, which is strapped to the patient's head and fastened by a set screw. In the absence of the mouthpiece, adhesive tapes may be used. In some cases, it may be desirable to substitute a shaft entirely of spiral spring for the whalebone.

It is Dr. Neff's practice to give the patient one-quarter grain morphine sulphate and 1/150 grain atrophin; otherwise the operator is handicapped by the flow of mucus. A 5 per cent solution of cocaine is sprayed on the fauces to reduce gagging to a minimum.



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Technique

Hanford, E. W.: Oesophageal Radium Applicator.—Surgery, Gynecology and Obstetrics, July, 1920, p. 84.

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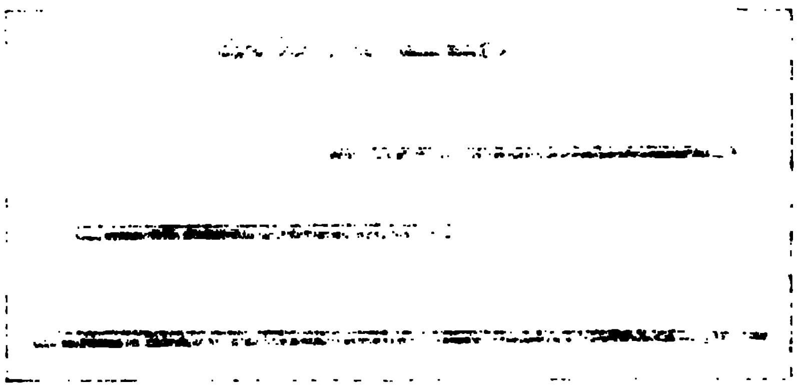

Failla, G., New York: Discussion of Dr. Janeway's Doses for buried Emanation.—*The American Journal of Roentgenology,* **July, 920; p. 334.**

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Dosage

"I should like to say just a few words about Dr. Janeway's doses for buried emanation. In a tumor 1 centimeter in diameter Dr. Janeway uses a dose of 5 millicuries. This means that he inserts into the tumor three or more tiny glass tubes containing a total of 5 millicuries of radium emanation. The tubes are distributed throughout the tumor mass as evenly as possible and they are left in the tissue indefinitely or until they slough out. The emanation in the meantime is decaying at the rate of one-half in 3.85 days, so that the radiation is getting weaker and weaker all the time. At the end of some weeks, depending on the initial amount of emanation used, the radiation is so feeble that it has no effect on the tissues. It will be noted, therefore, that there is a great variation in the intensity of irradiation between the first part of the treatment and the last. If we want to express the dose in millicurie hours, we multiply the number of millicuries by 132, this being the average life of the emanation. When radium is used for the treatments it is applied for a certain time and then removed, and the effect depends very markedly on the length of the exposure. Therefore it is impossible to compare the amount of emanation buried in a tumor with the amount of radium used for a similar treatment. The only thing we can do is to compare the above doses for buried emanation in millicurie hours with the dose in milligram hours for treatment with radium needles. But in this case, if we use the needles for the same number of milligram hours as millicurie hours calculated in the manner indicated above, we find that the effects are considerably more marked than in the case of the buried emanation. In other words, with radium needles unless we use a smaller dose, we get too severe a reaction."

Schmitz, Henry, Chicago: The Action of Radium on the Ovaries.—(Discussion in *American Journal of Roentgenology*, July, 1920, p. 385.)

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Effect of Rad
um on Ovari

The ovaries are in most instances 8 cm. from the uterine cavity. When radium is inserted into the uterine cavity it is usually left for 12 hours. If the erythema skin dose at 1 cm. distance is 100 mg. e. hours, then at 8 cm. distance it would be 6400 mg. e. hours. The sensibility of the ovary in comparison with the sensitiveness of the epithelial elements of the skin to the ray is about one-fifth of the latter. In other words, one-fifth the amount of an erythema skin dose will suffice to produce the same effect on the ovarian cells. Or, if it takes 100 milligrams radium element hours to produce this effect on the skin it will take only 20 mg. radium element hours for the ovary. If we divide 6400 by 5 we obtain 1200 mg. element hours as the dosage necessary to cause degeneration of the ovarian cells. Hence the 600 mg. e. hours applied for uterine hemorrhages have little effect on the ovary. The cessation of the bleeding is due solely to the action of the radium rays on the endometrium. Part of the endometrium receives an erythema dose, or a first degree burn, another part a second degree burn, and the portion in the immediate surroundings of the radium a third degree burn. If the endometrium is only partially destroyed oligomenorrhea occurs.

Radium rays have no effect at all on the myoma if it is composed of old connective tissue. The myoma will disappear after radiation if it is made up of young undifferentiated fibroblasts.

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Effect of R
um on Ova

Schmitz, Henry, Chicago: The Action of Radium on the Ovaries.—(Discussion in *American Journal of Roentgenology*, July, 1920, p 355.)

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Launois, Sargnon and Moutet, Paris: Radium Treatment of Tumors in Otorhinolaryngology.—*Bulletin de l' Academie de Medecine*, **May** 13, 1919. Abstracted in *Journal of American Medical Association*, August 16, 1919; p. 297.

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Otorhinolary
gology

Report their experience in forty-three cases, giving a brief history of each. In general non-epitheliomatous tumors were greatly improved, the patients often recovering completely under radium. In epitheliomata the results were less good, especially in the soft, ulcerated type. Epithelioma of the ectodermal type with hornlike whorls is little affected by radium, and may even be unfavorably influenced. The amount of radium bromide used by the authors ranged between thirty and 120 milligrams, applied wherever possible for 24, 36 and even 48 hours. In many instances, a second application proved desirable, but it was always made at as long an interval as possible after the first. Of sixteen tonsillar tumors, six were cured; these latter were lymphadenomas or sarcomas. Tumors of the nose, sinuses, and nasopharynx usually showed good results. The nasopharyngeal tumors were for the most part sarcomatous. Tumors of the larynx, fourteen in number, afforded only three recoveries.

Stevens, R. H.: The Efficient Dosage in Deep Roentgen Therapy.—
***Journal of Michigan State Medical Society*, 1920, XIX, 225.**

SHEET NO. 1

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Technique

Since too conservative treatment of malignancy will result only in failure and may even stimulate the growth to greater activity, it is a prime essential in radiotherapy to regulate the dosage for the results desired as far as this is compatible with safety. The action of roentgen rays and radium on the various types of malignant growths differs greatly; the more highly differentiated the type of cell from which the growth develops, the less responsive it is to treatment. In the less responsive cases even the dose that seriously burns surrounding normal tissue may not destroy the malignant growth. The results of roentgen-ray and radium therapy are both local and constitutional and to each of these agents there is a primary and secondary reaction. All of the effects must be given consideration in the treatment as each has an important bearing on the ultimate result.

The author is opposed to operation on malignant growths immediately after pre-operative radiotherapy. The objections cited to this procedure are that: (1) one series of radiations is not sufficient for a lethal dose for all the cancer cells of a deep-seated growth; (2) the blood vessels are primarily dilated and the tissues bleed freely, are more susceptible to infection and will not heal well; and (3) the lymphocytes are much diminished and consequently the patient's general resistance is greatly reduced. After two weeks the skin has passed through the primary irritation and is in better condition for healing, the lymphocytes have recovered, and the patient's resistance is improved. The blood vessels and lymph spaces are beginning to contract and fibrosis has begun. Consequently there is perhaps less hemorrhage than under normal conditions. If several series of treatments are given and followed by a three weeks' interval, the latter result is quite marked.

In conclusion the author states that the successful use of the X-ray or radium in cancer depends upon the following principles:

1. The dose must be a maximum dose that is safe for the life of the overlying and adjacent normal skin and the underlying important structures, but destructive to the less resistant malignant cell. This dose is difficult to determine. It varies with the type of patient treated and the type, location, extent, and depth of the growth. It is given through several ports in such a manner that the deeper parts are cross-fired by the ray. Such a dose is called a "series dose."

2. The series dose must be given at intervals of twenty-four hours or more until complete, in order to avoid too severe intoxication from proteid absorption.

3. The series dose must not be repeated until the skin and the blood have recovered from the effects of the previous series, i. e., from two to four weeks when the X-ray is used, and from four to six weeks when radium is used.

4. Operation should not be done after X-ray or radium therapy until the local sound tissues and the blood have recovered from the primary action of the rays, i. e., from two to four weeks.

5. Several series of X-ray treatments previous to operation and extending over several weeks are better in the average case than one

series of treatments. There is no necessity for a hasty operation in the average case of cancer. Time spent in X-ray or radium treatment before operation is not lost, but may mean the saving of a life in comparative comfort for a much greater period than if the operation were done first.

6. When it is possible to employ electrocoagulation in operation it often prevents recurrence for many months or years. It should be used much more frequently in operations on cancer.

7. Postoperative treatment should be continued for several months.

8. When thorough pre- and postoperative radiotherapy in cancer is used a much more conservative operation may be done, the neighboring lymphatics being treated by radiotherapy.

Holding, A. F.: Cancer Amelioration and Cancer Immunity.—*American Journal of Roentgenology*, 1920, n. s. VII, 306. Abstracted in *Surgery, Gynecology and Obstetrics*, October, 1920.

It is the purpose of this paper to correlate the known facts regarding the treatment of cancer and urge the co-operative employment of surgery and radioactivity to assist nature in establishing cancer immunity. Since there is no specific cure for cancer and since surgery and radiotherapy have each been proved of therapeutic value, a combination of the two promises better results than the use of either alone. Radiotherapy to be efficient must be administered in the most painstaking and scientific manner. A comprehension of how to administer the most heroic doses of radioactive energy with safety and when to administer it so that there may be no procrastination interfering with surgical intervention is essential. As regards the relative merits of radium and roentgen rays, the author gives the following comparative table:

RADIUM

Has more penetrating rays in smaller volume.
Easier to handle.
Applicators small in size.
Portable.
No danger of high tension electrical shocks to patient.
Can be used in cavities.
Effects easily confined to small areas.
Treatment takes more time—average treatment four hours per area.
Costs more.
No deterioration unless lost.

ROENTGEN RAYS

Have less penetrating rays in greater volume.
Technique very exacting.
Apparatus large and heavy.
Practically non-portable.
Patient must be protected from high tension shocks.
Use in cavities has been abandoned.
Larger areas can be treated.
Treatment takes less time—average treatment five minutes per area.
Costs less.
Constant deterioration due not only to wear but also to the fact that the apparatus soon becomes out of date.

In the author's opinion the most efficient treatment of cancer is based on: (1) the education of patients to the end that they will come for examination early; (2) the maximum safe erythema dose of radium or X-rays on the day previous to operation; (3) radical operation; and (4) postoperative prophylactic X-ray or radium treatments given with a careful technique.

Viol, Chas. H.: Conditions for the Production of Deep Thera-
tic Effects with Hard X-Rays and Gamma Rays.

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Dosage

In a paper by Sir Ernest Rutherford on the "Penetrating Power of the X-radiation from a Coolidge Tube," in the September, 1917, Philosophical Magazine, the mass absorption co-efficient in aluminum for x-rays, excited at a voltage of 92,000 is given as 0.14 and the corresponding value for the gamma rays from radium—C given as 0.026. For the x-rays, this represents the most penetrating voltage commonly used. Multiplying the given co-efficient by 2.7, the density of aluminum, gives the absorption co-efficient in one centimeter of aluminum, these values being respectively 0.387 for the hard x-rays and 0.0702 for the hard gamma rays. With these two values for the absorption of x-rays and gamma rays in aluminum as a basis, and setting the density of tissue as a unity, it can be estimated that the absorption co-efficient for the two types of rays in soft tissue will be approximately 0.14 for the hard x-rays and 0.026 for the hard gamma rays. To obtain the thickness of the tissues necessary to absorb half of a given type of radiation, when the absorption co-efficient for that radiation in the given tissue is known, the mathematical relationship is that the half absorption thickness of the substance equals 0.6931 divided by the absorption co-efficient. Therefore, with the above absorption co-efficient for the hard x-rays and gamma rays it may easily be calculated that the x-rays will be half absorbed in penetrating through 4.9 centimeters of tissue of density 1, whereas, the hard gamma rays of radium will be half absorbed only if passed through 26.5 centimeters of the same tissue.

In the application of radium energy to a deep-lying growth, such, for example, as in the attempt to ray malignant extensions, in the broad ligaments and lymphatic tissue in advanced cervical carcinoma, two factors come into play tending to reduce the intensity of the radiation which reaches the malignant tissue. The first effect is that of the divergence of rays, coming as they do from small sources which for convenience in calculation will be treated as point sources. The other factor is the partial absorption of the rays, which takes place on their penetrating through the tissue lying between the source of radiation and the tissue which it is desired to irradiate.

In terms of a skin surface or erythema dose, we will calculate the intensity of the hard x-rays available at a point four inches below the skin surface when hard x-rays having the above described physical qualities reach the skin surface from a point 8 inches away. On the basis of divergence of the rays, by means of the law of inverse squares, it may readily be shown that the intensity of the radiation four inches below the skin surface is reduced to 0.444 of the skin surface intensity and the four inches of tissue on the basis of the above-given absorption co-efficient will absorb 75 per cent. of the x-rays so that the intensity per unit area at four inches below the skin surface, in terms of the skin surface intensity as unity, will be 0.444x0.25=0.111.

Quigley, D. T., Omaha: The Technique of Radium Application.—
Minn. Medicine, II., 97-99, March, 1919. *Radium*, April, 1919.

"In considering dosage we may take the skin as the standard and as skin differs in thickness, nerve supply, etc., the average skin of the chest or abdomen may be designated. If then, we consider the burn we get from the application of 100 mg. radium for 10 hours encased in 1 mm. silver, 1 mm. rubber and 1 mm. of gauze, each tube so encased and each tube containing 25 mg., 60 per cent pure radium salt, this will represent the maximum dose such a surfare would stand without destroying the skin through its entire thickness, and which would heal in a reasonable time, and not leave adherent scars. Taking this as a standard and arbitrarily calling it 100 units we may compare the different parts of the anatomy usually exposed to radium rays as follows:

Skin of face, 75 units.
Skin of scalp, 125 units.
Skin of groin, 65 units.
Skin over buttocks, 125 units.
Skin over fascia lata, 125 units.
Skin over ear, 60 units.
Skin over eyelids, 50 usits.
Edge of eyelids, 80 units.
Eyeball, 80 units.
Mucous membrane of lips and cheek, 50 units.
Mucous membrane of tongue, 70 units.
Mucous membrane of rectum, 20 units.
Mucous membrane of urethra, 10 units.
Mucous membrane of larynx, 70 units.
Mucous membrane of bladder, 25 units.
Wall of uterus, 300 units.
Buried in tissues; bone, 300 units; muscle, 200 units."

"It will be seen that I consider the eye nearly as resistant to radium as the skin, and the uterus the most highly resistant of any organ."

"Embedded in tissue the reaction is not so severe as on the surface. The reason for this is probably because in a case where the radium is buried the surroundings are practically aseptic while on a surface or hollow organ there are more less micro-organisms to attack the tissues."

"In passing to pathology we find carcinoma the most resistant tumor we have to deal with. A 50 mg. tube will kill carcinoma cells for a distance of 4 cm., if left sufficiently long. Larger quantities will not do much if any better as regards distance, but will accomplish the same result in a shorter time. Sarcoma is probably twice as radiosensitive as carcinoma, the lymphosarcoma being extremely radiosensitive. Fibroma and myoma are perhaps the most radio-sensitive, a tumor the size of an eight months' pregnancy disappearing in four months time after 40 hours of treatment with 75 mg. of radium. Pedunculated fibroids respond as well as others if cross-fire is used. Angioma responds to treatment very readily but in children the tumor is much more radio-sensitive than in the adult."

"On the same basis of computation as we used in comparing histological differences, we may adopt 100 units as the dose for a skin carcinoma extending as deep as the deepest layers of the skin of a size that could be just covered by the tubes in question."

"Proceeding then to other pathological conditions we make comparisons as follows:

Carcinoma of skin one-quarter inch deep, 100 units.
Sarcoma (round cell), 50 units.
Angioma (adult), 50 units.
Angioma (child), 25 units.

Quigley, D. T., Omaha: The Technique of Radium Application.—
Minn. Medicine, II., 97-99, March, 1919. *Radium*, April, 1919.

Fibroma and myoma, 10 units.
T. B. (lupus), 40 units.
Melanoma, 100 units.
Lymphosarcoma, 80 units."

"These comparisons are made on the basis of the tissue being the same thickness and are not taken as practical examples, but solely for the purpose of illustrating the difference of radio-sensitiveness in different pathological tissues. For instance, a given dose of radium rays will destroy fibroid tissue ten times as far as it will destroy carcinoma, while angioma, sarcoma, and T. B. lesions are approximately twice as radio-sensitive as carcinoma. Melanoma is about the same as carcinoma and this is not to be wondered at for the modern trend of opinion is that these tumors are carcinoma. In practical work heavy screening should be avoided as much as possible except to protect normal tissues, as beta rays are probably very important to sedure the best results. Accurate approximation is another very important feature. I have seen a couple of radium tubes stuck carelessly into the vagina for cancer of the uterus without any regard to the accurate approximation of the diseased area with the tubes. Such methods can only bring bad results. The tube in these cases must be placed clear to the fundus and the whole uterus rayed. Five mg. to 75 mg. covered with ½ mm. silver and 1 mm. hard rubber and used for 70 to 80 hours in a week or ten days period, will give the best results in these cases. In these cases the cervix should be cross-fired by tubes placed horizontally against the cervix at the same time that the tube is inside the cervix."

"In dealing with radium the fact should be always borne in mind that intensity decreases as the square of the distance. For instance, a tube 1 mm. from a diseased spot will give a certain dose. Place the tube 10 mm. from the surface and give it the same time and you will not get one-tenth the dose, but one one-hundredth the dose given in the first instance. In other words to get the same dose at 10 mm. distance the time would have to be 100 times longer than at 1 mm. distance."

"A good deal of misunderstanding and confusion in the matter of radium technique has arisen because of comparing radium with the X-ray. It is well that the student of radium understand that these two agents are different, physically and in physiological action. It would be just as logical to compare arsenic with cane sugar because they are both white, as to compare X-ray with radium, because they both light up the fluroscope."

Turner, Dr. Dawson, (Edinburgh): "The Dosage of Radium."
The British Medical Journal, January 20, 1923, page 100.

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Dosage Techni

NOTES.

The duration of the application is a most important element in radium treatment, and it is one which there may be a tendency to overlook in institutions where large quantities of radium are available. Consider, for an example, a dose of 500 mg. hours, which would be a fair dose to administer to a small rodent ulcer. This dose might be given by 10 mg. of radium for fifty hours, or by 50 mg. for ten hours, or by 500 mg. for one hour. Does anyone contend that similar effects would be produced in each case? I have no hesitation in making the affirmation, based upon an experience of twenty years, that for each case there is a certain optimum combination of milligrams and of hours, and that this question is one for the radium expert to decide. Levin and Joseph, from an experimental study of the influence of radiations on the development and growth of the crown gall on plants, have shown that the primary effect of radium or x-ray radiations consists in the inhibition of the proliferating power of the cancer cells and not in their direct destruction. The crown gall, tumor-like formation on plants is so called because the growth frequently appears where stem and root join (called the crown). It is due to a parasite and can be induced artificially by inoculating the plant with an agar culture of the micro-organism. Plants were inoculated by these observers and some were submitted to radiation and some kept as controls; the control plants developed large crown galls, the others none or stunted growths containing true tumor cells. Cancer cells go through a cycle of (1) youth, (2) maturity, (3) old age. At one time they are actively dividing and at another they are not, and it has been shown that they are more susceptible to radiations when their nuclei are dividing than when they are in any other stage. In certain stages they may be as immune as normal tissues.

The lesson to be learned from a consideration of these facts is that in order that the dose of radium may be effectual, it must be applied for a certain time, for it is only by a prolonged application that we can make fairly sure of catching all the cancer cells in their susceptible stage. We will therefore conclude that small amounts of radium for prolonged periods are more likely to prove beneficial than large amounts for short periods. The oven may be too hot and the bread will be burned on the outside instead of being baked throughout.

To take another point: Suppose one possesses 100 mg. of radium, in what quantities is it best to put it up into tubes? The answer depends mainly upon the nature of the diseased condition to be attacked, upon its situation, its area, its volume, and upon whether the radium is to be applied externally or buried in the growth. Take the case of lymphosarcoma—perhaps the most susceptible of all growths to radium—of the size of a large orange; in this case it would be best to have the radium put up in 5 or 10 mg. portions in separate tubes, so that they could be distributed throughout the mass, and particularly arranged like sentinels around the borders of the growth, for in this way the central parts will be receiving cross-fire radiation from all the tubes, but the peripheral

parts will only get efficient radiation from the paripherally placed tube which happens to be nearest. In order that the whole growth may be efficiently and uniformly radiated the radium should theoretically be uniformly distributed throughout it—in fact, the desideratum would be to scatter radium like pepper from a pepper pot throughout the mass. Though this is for several reasons impracticable yet the more nearly we can approach to it the better. Dr. Stevenson's needles are a means to this end. Small tubes are filled with radium emanation and are enclosed in hypodermic needles for embedding in the neoplasm. There is a disadvantage which applies to all cases in which the emanation is used, owing to its steady loss of strength—namely, that the dosage is not known unless the tubes have been tested for their emanation strength before being employed and unless a table of their rate of decay be consulted. As the time element in radium treatment, as I have endeavored to show, is important, emanation tubes have the disadvantage that they would have to be replaced from time to time by freshly charged ones. Where the application is external this would be easily done, but in the case of a tumor in which the radium is embedded, it would mean a minor surgical operation each time the emanation tubes were charged.

Another point of importance is to give the whole maximum dose at first, and not to break it up into smaller ones which are repeated. The latter course may in certain cases turn out a fatal error, and this chiefly because the malignant cells, which were stunned but not killed by the first application, will, when they recover, tend to breed cells which are more immune to radiation, until, the same process continuing after several exposures, only those cells will survive which are refractory to the rays. There is a tendency by natural selection to breed cells which are immune, and further exposures will now only do harm. The knock-out blow should be given by a sufficiently long exposure to a sufficient amount of radium while the cancer cells are not suspecting an attack; they must be taken by surprise, so that they will be unable to organize a resistance and be incapable of putting up a serious defence.

Were more attention paid to these points there would, I venture to think, be fewer failures following radium treatment.

Israel, Dr. Sidney: **"X-ray Treatment of Tonsils and Adenoids:**
Preliminary Report. Abstracted in the *Journal of Radiology*, Feb-
uary, 1923, from *Texas State J. M.*, 18:301, October, 1922.

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Tonsils and
Adenoids

NOTES.

The author has attempted to prove to his own satisfaction whether the claims of Witherbee are justified and whether radiotherapy of tonsils and adenoids should have a prominent place in the treatment of these structures. The cases selected for x-ray and radium treatment have been those deemed inoperable because of various reasons. As the result of his work, the author found that x-ray or radium would produce a definite atrophy or shrinkage of the tonsil and adenoid tissue. In many cases in which one could express quantities of cheesy material from the crypts before treatment, this was no longer possible, after the atrophy occurred. Further the local symptoms disappeared. He compares the two methods of treatment as follows:

TREATMENT.

Operation: Hospital expense, anesthetic with possible pneumonia or lung abscess, contraindications frequent, hemorrhage, pain, loss of weight, loss of time, no tonsils, deformity from scar tissue or injury, time consumed about ten days.

Radiotherapy: No hospital expense, no anesthetic or anesthetic dangers, no operation, no hemorrhage, no pain, no loss of weight, no loss of time, tonsils atrophied, but still present, no deformity or injury, time consumed six to ten weeks.

CONCLUSIONS.

The author feels that radiotherapy will not replace a well and carefully performed operation. There is a strong likelihood that a definite place will be established for radiotherapy in laryngology as a therapeutic measure applicable to a certain number of cases.

Schlagintweit, Dr. E. and Seilman, Dr. H.: "Salt Solution in
adiation Sickness." Abstracted in the *Journal of Radiology,* Janu-
ry, 1923, page 28, from *Klin. Wchnschr.,* 48:2136, October 21, 1922.

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Radiation Sic
ness Treatmen

NOTES.

These authors believe that radiation sickness results from a disturbance of the sodium chloride metabolism. The salt concentration in the serum falls rapidly after radiation, remains on this level for a few hours and slowly returns to normal. Due to this change there occurs a change in the osmotic pressure bringing about the syndrome of radiation sickness. It is suggested that this condition be remedied by supplying the necessary quantity of salt.

TREATMENT.

The authors treat radiation sickness by injecting 300 to 1,000 cc. of physiological salt solution per rectum, or 5 to 10 g. per os, or 1.0 g. in five per cent intravenously. It must be administered slowly.

This treatment always proved to be successful. About fifteen to twenty minutes after the injection, especially the intravenous method, marked improvement was noted. Nausea and vomiting ceased and patients asked for food. There can have been no possibility of a psychic effect, as the patients did not know the object of the injection.

The authors recommend this treatment most enthusiastically.

Schlagintweit, Dr. E. and Sellmann, Dr. H.: "Salt Solution in Radiation Sickness." Abstracted in the *Journal of Radiology*, January 1923, page 98, from *Klin. Wochnschr.*, 43:2136, October 21, 1922.

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These authors believe that radiation sickness results from a disturbance of the sodium chloride metabolism. The salt concentration in the serum falls rapidly after radiation, remains on this level for a few hours and slowly returns to normal. Due to this change there occurs a change in the osmotic pressure bringing about the syndrome of radiation sickness. It is suggested that this condition be remedied by supplying the necessary quantity of salt.

TREATMENT.

The authors treat radiation sickness by injecting 300 to 1,000 cc. of physiological salt solution per rectum, or 5 to 10 g. per os, or 1.0 g. in five per cent intravenously. It must be administered slowly.

This treatment always proved to be successful. About fifteen to twenty minutes after the injection, especially the intravenous method, marked improvement was noted. Nausea and vomiting ceased and patients asked for food. There can have been no possibility of a psychic effect, as the patients did not know the object of the injection.

The authors recommend this treatment most enthusiastically.

**Rolleston, Dr. Humphry (London): Acute Constitutional Symp-
oms Due to Radiation.** *The British Medical Journal*, January 6,
923, 1-4.

SHEET NO 1

FILE UNI
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Technique
Symptoms Di
to Radiation

SYMPTOMS AND THEIR CAUSE

X-rays and radium are very powerful agents and have a wide field of application in the treatment of disease; as a form of energy they exert a profound effect on metabolism, acting in either a stimulating or destructive manner according to the conditions of their dosage and the state of the body.

The selective action of irradiations on the tissues, or the sensitiveness to rays of the various cells of the body, is important both from the point of view of treatment and of the ill effects that may thus be induced. The destructive action exerted by radiations on the blood-forming organs, especially on lymphoid tissue, has attracted much attention recently on account of the unfortunate fatalities among x-ray and radium workers.

Experimental investigations of the changes in the lymphocytes have been carried out by Mottram, S. Russ, Leitch, Lazarus-Barlow, Hess, Unger and Steiner, and others; and G. E. Pfahler has quite recently reviewed this subject. The chronic blood changes and ill health that may occur in x-ray and radium workers are now generally recognized and guarded against. The action of radium on the nervous tissues has been much investigated since 1903 by Danysz, Obersteiner, Alquier, and Faure-Beaulieu. In 1911 Horsley and Finzi applied filtered radium rays directly to the brain, and stated that the nerve cells were unaltered, but that from damage to the blood vessels hemorrhages occurred. In 1922 Morowoka and Mott, from histological examination of the brains of animals whose heads had been exposed to a large amount of radium, attached importance to the protective action of the skull. Pendergrass, Hayman, Houser and Rambo, employing various methods of acting on the brain by radium, found that the nerve cells were first destroyed and then underwent autolysis. Bone is the most resistant tissue of the body to radiations, but Regaud found that it may show necrotic changes from x-rays without any concomitant damage to the skin. The remarkable sensitiveness of the mucous membrane of the small intestine in dogs to x-rays has been shown by Warren and Whipple, who found that the lymphoïd tissue in Peyer's patches was much less susceptible; Lazarus-Barlow's experiments also showed that the mucosa of the small intestine of cats, rabbits, rats and frogs was damaged by the gamma rays of radium. Warren and Whipple ascribe the grave constitutional symptoms produced in dogs by exposure of the abdomen to enormous doses of x-rays to the lesion of the small intestine.

Captain A. E. Hayward Pinch of the Radium Institute allows me to quote him to the effect that he has no knowledge of acute constitutional symptoms of radium workers, but he refers to a real systemic disturbance due to auto-intoxication and characterized by slight fever and general malaise in patients, especially those with lymphosarcoma, after deep radium therapy. According to Bowing, mild reactions, such as malaise, anorexia, nausea, and occasional vomiting, are usually disregarded at the Mayo Clinic, but when a severe reaction occurs the radium treatment is usually omitted for two or three days.

TREATMENT.

TREATMENT is the first and foremost preventative; to avoid the early transient disturbance the x-ray rooms should be properly ventilated. The avoidance of the grave constitutional symptoms mainly depends on care in the technique and dosage, but other factors may play a part, and the state of the organism must be taken into account. Proust, Mallet, and Coliez mention a red blood count below four millions and a low blood pressure as indications that x-ray therapy should be conducted with great caution. In order to avoid toxaemia Beck practices surgical exposure and surgical removal of as much as possible of the growth, and then treatment by x-rays or radium of the remainder of the tumor in the open wound. In this way any discharge from the radiated tissue passes into the dressing instead of into the circulation and toxaemia is minimized. Another advantage is that a smaller dose of radiations is required than in the ordinary method of treating deep-seated tumors. In 100 cases thus treated he had not had any death from toxaemia, whereas with the usual method four of his patients had died from toxaemia.

It is to be hoped that Auer and Witherbee's experimental protection of the skin of rabbits against the harmful effects of x-rays by the previous injection of horse serum may be applied to protect the deeper tissues of man against radiations. But before this is done further work is necessary; it is not yet known if the sensitization produced by horse serum increases the resistance of the cells of malignant growths to radiations.

FILE UN

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Technique

Colloid Ca

Parham, Duncan, M. D. (Rochester, Minn.): **Colloid Carcinoma.**
nnals *of Surgery*, January, 1923, 103-104.

CONCLUSIONS

1. In colloid carcinoma the epithelial cells possess an uncontrolled function of secreting a mucinous substance. Its accumulation is often destructive of the carcinoma cells.

2. Mucus formation is a sign of functional differentiation of the carcinoma cells, corresponding to the morphologic differentiation seen in the carcinomas with cells of the acinar or columnar type.

3. The mocus-forming characteristic may be possessed by cells showing other morphologic signs of differentiation and by those not showing such differentiation.

4. Colloid carcinomas occur in the stomach (6.5 per cent.); caecum (22.2 per cent.); appendix (7.0 per cent.); transverse colon (7.3 per cent.); sigmoid (4.3 per cent.); rectum (5.5 per cent.); pancreas (two cases); gall-bladder (8 per cent.); salivary glands (one case); bladder (2.5 per cent.); prostate (one case); kidney (one case); ovary (1.1 per cent); and breast (1.12 per cent.). Peritoneal carcinomas occur in 16 per cent of all cases.

5. Colloid carcinoma is usually slow of growth and late to metastasize to glands and other organs. It often grows by permeation and may cause extensive thickening of the wall of the affected organ.

6. Local glands are often involved long before metastasis has reached distant glands. Though histologically less malignant on account of permeation of adjacent tissues, it is particularly difficult to eradicate. Death is often delayed, but the eventual mortality is greater than in other types of carcinoma.

7. Recurrence is often entirely localized to the site of origin.

8. Many patients with colloid carcinoma respond remarkably well to treatment by Roentgen-ray and radium.

k, John G., M.D., and Keene, Floyd E., M.D.: (Philadelphia):
Hemorrhage of Benign Origin Treated by Irradiation."
of the A. M. A., Vol. 79, No. 7, August 12, 1922, p. 546.
SHEET NO. 1

An analysis of 527 cases of myomi uteri and myopathic lesions.

"Adolescent Girls and Young Women.—In these young persons, after an examination under anesthesia for the purpose of accurately defining the pelvic conditions, we may with safety apply 50-mgm. for from three to four hours. This usually proves effective in regulating the periods; but we never reach any conclusion as to its failure to cure under six months, for we fear the effects of a too early repetition of the treatment. Should the second irradiation be necessary, the first having been partially or wholly ineffective, we then increase the time from four to six hours, depending to some extent on the size of the uterus and the severity of the bleeding. In our experience, the second application is always effective."

"Young Women.—With this disposal of myomas occurring in young women, it will be noted that surgical intervention takes decided precedence over that of irradiation, leaving relatively few cases open to the latter treatment. As a result of our experience, we usually restrict the dosage of radium to 50-mgm. for from six to twelve hours in these younger women. In such instances the menstrual periods may recur more or less normally after a variable period of amenorrhea."

"Middle-aged Women.—In the group of women aged from 35 to 45 the question of the maternal possibilities as well as the sexual life of the person becomes of much less importance in the choice of treatment. Usually, the maternal equation is either settled by the patient having a family, or the myomatous changes in the uterus have so distorted its structure as to render the patient sterile, or have made child-bearing impossible. Further the cessation of the ovarian function in women who have established sexual habits is of far less moment in its influence on this function. If either of these phases stand out prominently in the patient's mind and she fears the abrogation of either, we incline toward surgical intervention. The ultimate happiness of the patient must have equal consideration with the restoration of physical health; for the latter without the former may have little merit in the mind of a patient suffering under a cloud of such misgiving. In such cases, a follow-up letter does not bring a very cheery or grateful response, even though the patient's life may have been saved. However, in considering the use of radium, we find that this question has largely been settled by the fact that the patient has passed the fortieth year. At this period, therefore, the preference, in case of doubt, always falls in favor of radium; whereas, in younger women, surgery is almost invariably the remedy chosen."

"Women in Climacteric Years.—In the group of cases formed by women in the climacteric years, radium occupies a premier position; it is effective, it is quick in giving relief, the treatment does not incapacitate the patient. It is safe, and it is followed by practically no disabling sequelae or remote ill effects, as our summary will show. With our experience as a guide, we have ceased to summarize what may happen from three to five years after irradiation; for, without

exception thus far, we have nothing to record in the way of so-called continuing or remote changes which may be counted as a backflare of the treatment. This statement is now well grounded on the careful study of cases running back six years. The fear of sarcomatous transformation of the tumor is without foundation, for in not one single instance has this malignant change been noted after irradiation in this large series. Hence, any criticism of radium treatment on this false assumption is without support. The cure in these cases is prompt, and the only after-effects are those noted in all women passing through the menopause. Many pass through this trying period with scarcely a complaint; others are troubled constantly; while a few have a very stormy and, occasionally, a prolonged period of adjustment. At times we have thought that possibly a menopause induced by irradiation is more violent than in other series of cases in which the climacterium is surgically induced; but when a large series of patients who have undergone double ovariotomy is compared with those who have been submitted to irradiation, the two are found to be similar."

"Leukorrhea.—Frequently, after an intra-uterine application of radium, a thick yellowish leukorrhea develops, which is slight in amount and is seldom if ever persistent, rarely lasting more than from six to ten weeks. Frequently, it is so insignificant that unless the patient's attention is called to it, she does not refer to it. Further, along this line, there is a gratifying sequel in that a persistent leukorrhea is not infrequently cured by the treatment. We, therefore, lay little or no stress on the presence of leukorrhea as a sequel, because it is evanescent in character, and requires little or no attention."

"Menopause.—Irradiation in a dosage of 50-mgm. for twelve to twenty-four hours, will produce climacteric symptoms of varying degrees of intensity in 60 per cent. of cases. In 36 per cent. the symptoms will be marked or severe. As a rule, they persist for from a few months to two or three years, and then subside. In an occasional case, severe symptoms may persist for several years. Menopausal symptoms seldom if ever occur in young women when a dosage of 50-mgm. is applied for from six to eight hours; and in no case has the climacterium been induced by this dosage. Larger doses will produce these symptoms, but it is our impression that they are usually neither so persistent nor so severe in younger women as those of menopausal years. Strangely, this observation is at variance with the usual conception of the menopause, but it is in line with the statement of Clark and Norris in their analysis of cases after a complete hysterectomy. From this study we also draw the conclusion that the age factor in its relationship to the menopause is not nearly so much to be taken into account as the temperamental and nervous factors. Thus, a highly strung woman with poor nervous governors is very likely to be thrown out of balance by the precipitation of the menopause, be it early or late. This point we would especially emphasize."

Clark, John G., M.D., and Keene, Floyd E., M.D.: (Philadelphia):
"Uterine Hemorrhage of Benign Origin Treated by Irradiation."
ournal of the A. M. A., Vol. 79, No. 7, August 12, 1922, p. 546.

SHEET NO. 3

FILE UND
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Hemorrhage

“Under nitrous oxid and oxygen anesthesia, a careful pelvic examination is made. The size of the uterus is ascertained, and its depth measured by a sound and recorded for future reference. A thorough curettage is performed, and the curettings are saved for microscopic diagnosis. A 50-mgm. tube of radium properly filtered is inserted to the fundus of the uterus. The duration of the application depends largely upon the age of the patient; in women at or near the menopause, the duration is usually twenty-four hours, and in young women proportionately less. A repetition of the application in young women is preferable to over-irradiation.’ ’

“A point which we always emphasize in the use of radium in all cases of benign hemorrhage is that one intra-uterine application of 50-mgm. for twenty-four hours suffices to cure the case effectively. We therefore, strongly deprecate the repetition of these treatments, since each application carries a minimum danger with it, and has no merit whatever over one application which effectively cures. Also, we do not favor coincident roentgen-ray treatments, for they are quite unnecessary.”

“The immediate results of irradiation are not unlike those of a simple curettage, with the exception that nausea is likely to be more persistent during the retention of the radium within the uterus. In all of the list of 527 cases, we have had no case of vomiting so persistent or prolonged as to give the slightest cause for anxiety. Usually, within one or two hours at most after the withdrawal of the radium, the nausea and vomiting cease. In a few instances, these symptoms have persisted for three days. As a rule, these patients remain in the hospital for five days; for we follow the rule here that we observe in any case of simple curettage. It is unwise to permit the patient to go home the second day after irradiation, since the surgeon must see the patient through any possible danger arising from his surgical intervention, and such dangers are not past within twenty-four hours. As a rule, the patient sits up the third day and leaves the hospital the fifth day.”

“The standing rule is for all of these patients to return for examination at the end of from six weeks to two months after treatment. If the patient lives at a distance and cannot return, a personal letter as to her condition is requested of the patient or of the attending physician. From our study of these final results, we feel that a three-year period suffices for a complete observation. By no means do all tumors disappear and a few do not diminish greatly in size, but as the majority of these cases have been treated solely for hemorrhages, with the cessation of this symptom the patient may be looked on as cured. After irradiation, the great majority of tumors either shrink greatly in size or disappear completely. A subperitoneal tumor is not likely to be greatly influenced by irradiation.”

Pomeroy, Lawrence A., M.D., F.A.C.S., and Milward, Frank W., M.D., Cleveland, Ohio): "A Case of Primary Carcinoma of the Female Urethra Treated With Radium." *Surgery, Gynecology, and Obstetrics*, Vol. xxxv, September 1922, p. 355.

FILE UND
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Carcinoma of Ureth

"1. Primary carcinoma of the female urethra is a rare disease, our case bringing the total reported in the literature to 69.

2. Urethral caruncle, although a relatively common affection of woman, may be followed by malignant degeneration, hence the importance of its early recognition and treatment.

3. Cancer in this location, although rare, should be recognized early and rigorous treatment instituted.

4. Treatment in the early cases consists of radical extirpation even to the extent of resection of the bladder, but this should be rarely necessary. In most cases the vesical sphincter can be saved in the operative procedure.

5. Radium should follow all operations and may be used alone in the well advanced cases.

REPORT OF CASE

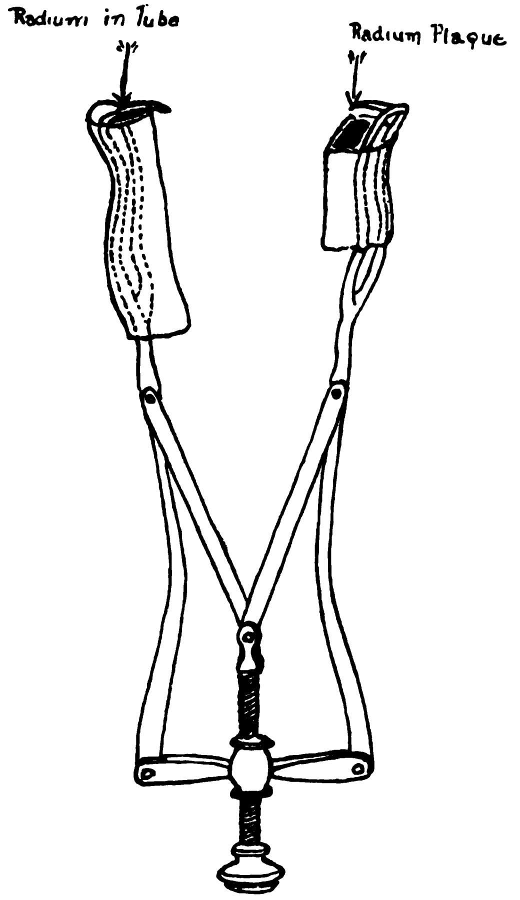
"Under ether anesthesia a complete examination was made, a small portion of tissue being removed for pathological diagnosis. Five steel needles each containing 10-mgm. of radium element were inserted directly into the tumor at about equal intervals from each other and allowed to remain in position for 12 hours. In addition, one tube containing 50-mgm. of radium element, screened with 0.5 mm. silver, 1 mm. brass and 1 mm. hard rubber was inserted into the urethral canal and allowed to remain for four hours. This made the total radium treatment 800 mgm. hrs. The patient had only the usual postoperative and radium nausea and 2 days following the treatment was up and about without any unusual symptoms. Twelve days after treatment the patient had suffered no tenesmus or other symptoms, and examination revealed the mass to be one-third less in size, much cleaner and accompanied by considerably less discharge."

Richard. **"Radium Treatment of Cancer of Uterine Cervix."**
Paris Medicale. Abst. Jour. A. M. A. xii, 511, 855, June 17, 1922.

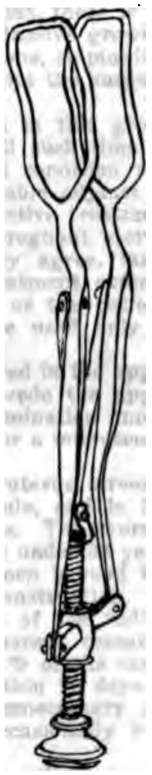
FILE UND
U
Cancer of Cervix

Richard's review of recent literature on this subject extols the progress that has been realized. Many patients have been given at least the illusion of a cure who in other days would have been regarded as beyond all hope of relief. We might even conclude, he says, that the malignant disease had been cured if we did not know of the liability to recurrence after several years of a clinical cure. We must wait now for time to tell which of the methods that have been applied give the best results. It may prove that the best ultimate results have been realized with methods that did not give the most encouraging immediate results. He warns against any active measures when there is cachexia, as the reaction to the irradiation is more than such persons can stand. Another contraindication is invasion of the bladder or rectum, and cystoscopy and rectoscopy are indispensable to exclude this. Extensive invasion of the vagina is a further contraindication, as also invasion of the lumbar glands. This may be suspected if there is much persisting pain in the lumbar region.

Moreton, F., M.D. (Geelong, Victoria, Australia): "Speculum for Applying Radium to Mouth and Throat."



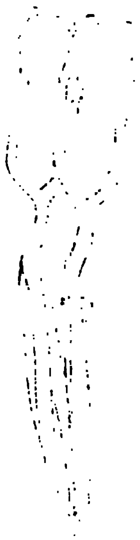
Lying down flat



Lying on it's side

Dr. Moreton says;—

"The instrument is more or less a nasal speculum. The radium plaque or tube is attached to the speculum by means of a strip of adhesive plaster. The latter becomes a filter or window as required. In its application to the part affected, obviously one shank is placed inside the mouth or throat, the other shank outside. We have now the additional advantage of cross-fire and that graduated pressure so necessary is provided by the fine screw-adjustment. The instrument is light, strong and adaptable to many modifications to suit the various parts treated. A similar speculum with a longer shank has been used to check hemorrhage from a bleeding tonsil after operation, and I know of no other method to equal it. Radium could be applied to the tongue with the same instrument. Even the tongue should give no difficulty. To the same speculum, at its apices, may be attached, teethlike a snake's fangs in order to maintain a grip of the tongue if found necessary. There may be an objection to using XO plaster containing zinc, as it may cause a surface burn. Other substances could be used if preferred."



Miller, G. Jeff., M.D., New Orleans, La. "Radium Treatment of Myoma of the Uterus and Myopathic Bleeding." Surgery, Gynecology and Obstetrics, June 1922.

SHEET No. 1

"Large myomata should be treated by myomectomy or hysterectomy. Unless some contra-indication to operation exists, there is no valid reason for the use of radium in large tumors. Massive growths too often present serious complications such as adhesions, salpingitis, degenerative changes and pressure symptoms, to prompt the surgeon to depend upon radiation as the method of election.

Radiation has, however, a distinctive application in this group in that it will promptly control the hemorrhage until such time as the consequent improvement in the patient's general condition will render her a safe operative risk. Radium is a valuable adjunct to surgery in this group, but it should seldom be the elective treatment in myomata larger than a three and a half months pregnant uterus. Upon this point the majority of observers generally agree, large growths only partially shrink, and the period of treatment extends over too long a time to satisfy either the physician or the patient. Therefore, in cases of this group, radium should be used only in exceptional instances.

It is apropos to mention here the technique followed in the application of radium. Preliminary curettage should precede the application in order to permit a careful bimanual examination under anesthesia, to eliminate small polypi, and to provide for a microscopic examination of the uterine scrapings.

The radium is introduced into the cavity of the uterus screened by brass and rubber or frequently a celluloid capsule, and is left in situ from 3 to 24 hours, according to the indications. The average time of exposure in our series of young women—those under 38 years of age—was 12 hours in cases of myomata. In women beyond this age, where it was not so important to preserve menstruation, the treatment lasts 24 hours. As a rule, 50-milligrams of the radium element was employed. This dosage produced permanent cessation of menstruation in women over 40 years of age in 94% of the cases. In our earlier work a second exposure was made within 10 days or 2 weeks, but it was soon observed that this was unnecessary and often caused discomfort that was persistent and occasionally very distressing.

At present we believe that one application is sufficient, and that subsequent exposures should be given only as indications develop. The recession in the size of the growth may appear unaffected for several months, and then suddenly show a rapid shrinkage. For this reason repeated exposures should be cautiously advised, and repeated examinations should be made to check the status [illegible] the tumor. Lately we have preferred to make 15-hour exposures, and to repeat the application in 3 or 4 months if it is necessary. We have found that, even after reducing the exposure the single application is usually sufficient. This permits of its use in younger women, since our experience has shown that in many cases menstruation will reappear in several months, or as late as 2 years, and continue normal thereafter. Furthermore, the menopausal symptoms are apparently less marked when the shorter exposures are employed. One hundred and two of the 107 cases reported complete relief [illegible] hemorrhage within 5 months after radiation. Two of the remaining five required a second application before being relieved. Two cases were not relieved by a sécond exposure, and the remaining case [illegible] eventually subjected to hysterectomy in another clinic. These results practically correspond with the results obtained by other observers, and prove conclusively that no other agent at our disposal [illegible] radium in controlling excessive uterine bleeding.

ark, John G., M.D., Frank B. Block, M.D., Philadelphia. therapy of Non-Malignant Menorrhagia." American Journal ical Sciences, April 1922, p. 614.

"The present status of radiotherapy of non-malignant uterine bleeding has been fairly well summarized by Graves (Surg. Clinics of North America, June 1921, p. 620), who reminds us that before the advent of radium, uterine bleeding in adolescence and young womanhood presented a baffling problem. The etiology of this condition has never been solved. The various remedies for this condition, such as animal serums, gland extracts like pituitrin, the various styptics, iron, arsenic, etc., are all of very equivocal value and repeated curettings are equally useless. The bleeding not infrequently continues for years, and may reduce the patient to an extreme state of anæmia, in a number of cases the writer being obliged to resort to hysterectomy and castration. In the earlier days of radium, as a therapeutic agent, it was applied only for the menorrhagias of women near the menopause. Operators were fearful of using it in young women on account of the danger of bringing about an artificial menopause. It was soon discovered that when radium was given in moderate dosage, excessive menstruation may be diminished and regulated with a fair degree of certainty. Therefore, at the present time, it is employed without hesitation for urgent cases, even in pubescent girls. In making the decision as to the treatment of a very young patient, the question of the danger of causing a complete cessation of the menses has been a most important one, but the writer is convinced by experience that a dosage of 25-mgm. for from four to six hours may be given with entire safety and he believes that it is quite probable that the ovaries of the young are able to withstand a greater exposure to radiation without losing their function than are the ovaries of older women. In regard to the manner in which radium produces its effect, he believes, with many others, that the rays exert an influence on the endometrium as well as on the ovaries. Radium given in sufficiently large doses is capable of destroying the Graafian follicles, as has been shown by the examination of ovaries that were removed following radium treatment. The extent of the destruction of the follicles depends upon the size and length of time of dosage and also on the age of the patient. The primordial follicles are formed near the center of the ovary and as they develop they migrate toward the surface, finally culminating in a ripe corpus luteum or an atretic follicle. A large dose of radium is sufficient to destroy all of the follicles in the ovary both young and old, but it may be imagined that a moderate exposure of the radium may kill only the older and riper follicles that are near the surface, while the younger and less-developed bodies escape its influence. In this way may be explained those cases in which the menstrual function is suspended for several months only to be resumed in a natural manner. In other words, menstruation ceases during the period of time required for the younger follicles to mature. The fact that menstruation is in most cases restored without the abnormal bleeding which before characterized it may be explained by some minute but permanent change in the endometrium."

Clark, John G., and Frank B. Block, M.D., Philadelphia. "Radiation Versus Surgery in the Treatment of Myomata." American Journal of Medical Sciences, May 1922, p. 767.

SHEET 1

FILE UNI

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Myomata

"The working rules that have been adopted by Crossen (Jour. Missouri State Med. Assoc., 1922, 19, 55) are that radium is the preferable form of treatment in uncomplicated small and medium-sized myomata in patients in the menopause or near the end of the child-bearing period. Persistent bleeding is usually the serious symptom in these cases and this is promptly checked by radium, which controls all bleeding, menstrual or otherwise. Nearly all properly selected cases prove amenable to this treatment. It is very important to exclude carcinoma of the endometrium by performing a diagnostic curettage before subjecting the patient to radium treatment. In patients with kidney, heart and other complications giving undue operative risk, radium may be reasonably tried in the somewhat larger growths, especially in those cases where roentgen-ray treatment produces such marked nausea and ill-feeling that it is not advisable to continue it. The larger growths in patients presenting undue operative risk are best handled by deep roentgen-ray therapy. In most cases this will, after a time, stop the bleeding temporarily and give a chance to build up the patient for operation. If she cannot be gotten into condition for operation, continuation of the roentgen-ray treatment may stop the bleeding permanently and diminish pressure symptoms by shrinking the growth. If preferred, the smaller growths also may be treated by roentgen-ray instead of radium, with practically the same percentage of symptomatic cures. In over 600 reported cases of myoma treated by roentgen-ray the bleeding was stopped in approximately 95%. However, the roentgen-ray treatment has the disadvantage of extending over a long period of time, or if given in more massive doses in a short period, of upsetting the patient's digestive and nervous systems, in some cases to a serious extent. Large growths, larger than a grapefruit, are best handled by operation. It is not practicable to fix an arbitrary rule of size as other complications have a bearing on the decision. For example, pedunculated subperitoneal growths are not so favorable for radiation as those embedded in the uterine wall and hence must more often be removed by operation. Again, a single large growth is not so favorable for non-operative treatment as a myomatous uterus enlarged to the same size by a number of small nodules. In young women, in whom preservation of the child-bearing function and of menstruation is desirable, myomectomy is the preferable form of treatment, where any serious treatment at all is necessary. In many of these cases the myomata may be removed without disturbing the functions of the uterus. However, a point to be kept in mind is that when the abdomen is opened it may be found necessary to sacrifice the uterus in order to remove the tumors completely, hence myomectomy should be advised only after careful consideration of all the features of the case. If the growths are not of a size and location necessarily interfering with pregnancy or labor, it would be well to try first to check the bleeding by other means, such as curettage and internal medication. If these measures fail, it may be advisable in exceptional cases to employ light doses of radium or roentgen ray with the idea of giving just enough to control abnormal bleeding but not enough to affect ovarian or uterine function seriously. But in spite of advances made in the regulation of the dosage and the enthusiastic assumptions

of some authorities, the writer regards this as hazardous to the preservation of function and hence employs these measures for this purpose with very decided caution. If the roentgen ray is used, it is preferable to apply it to one side only, so that one ovary will remain unaffected. In complicated cases, the complications often make operation advisable in a growth which if uncomplicated, would be suitable for radium or roentgen-ray treatment. The complications may be inflammation of some adjacent structure, for example. appendicitis or salpingitis. Such associated trouble is found in a considerable proportion of the cases of myoma. It should be remembered that a myoma that begins to grow after the menopause is probably undergoing a degenerative change of some kind and should be promptly removed if the patient is a safe operative risk."

Soiland, Albert, M.D., F.A.C.S.. Los Angeles, Calif. "Concerning Radiation in Pelvic Cancer."* Southwestern Medicine, Feb. 1922, Vol. VI, No. 2, pp. 47-48.

FILE UNDE

U

Uterus, Cance

*See article filed under Cancer of Cervix.

"In cancer of the body of the uterus, the technic is practically the same, except that radium is carried up to the fundus, if possible. If this cannot be accomplished, radium is packed in an additional two millimeters of hard rubber filter, the rectal wall is protected with two millimeters of lead, and the entire mass inserted into the posterior cul de sac, additional tubes are placed in each fornix, and the exposure carried up to six thousand milligram hours, within six days' time. The x-ray cross-fire is directed through six ports of entry on the abdomen, giving a total of 900-milliampere minutes with ten millimeters aluminum filter, one-half inch cotton filter, under compression, one hundred kilovolts, five milliampere tube circuit, at an eighth inch skin-distance."

Polak, John Osborn, M.Sc., M.D., F.A.C.S., Brooklyn, N. Y. "Notes on the Clinical Value of Radium in the Management of Uterine Hemorrhage," Medical Record, March 25, 1922, Vol. 101, No. 12, pp. 493-494.

Radium has established for itself a definite place in gynecology in the treatment of uterine hemorrhage; not only in the bleeding caused by fibroids, but in the so-called myopathic bleeding in young girls and spinsters, and the excessive menstrual flow met with in women with subinvolution and fibrosis of the uterus. It has a further place in the treatment of leucorrhea resulting from cervical inflammation, and while it cures this condition by the destruction of the glands and the substitution of scar tissue, it is less destructive to the cervical tissues than any of the several forms of excision.

Its admitted use in cancer is granted, and personally we feel that it is only a matter of time when it will replace operation, for all cancer is cured by the individual producing an immunity against the disease. This immunity, operation breaks down, and hence cancer grows and metastasis takes place unless the removal has been complete. Gaylord has shown that it is possible for mice and rats to product immunity against implanted growths and live for months and even years with a localized swelling which has no tendency to spread until the resistance is lowered by blood loss or anesthesia—then the cancer promptly grows.

When one thinks of the long, radical operation, with its extensive tissue exposure and trauma, and the prolonged anesthesia necessary to perform this operation, one can readily see how the patient's immunity is necessarily reduced. This explains the prompt recurrence following many of our incomplete efforts at removal and is to me the most striking illustration of why radium, which has a special selective action for certain tumor cells, effects a cure, or at least increases the longevity, for the individual resistance is not impaired.

During the past six years we have been using radium almost daily, with more or less success. Our follow-up system, which is detailed, has given us the opportunity to see the results, modify our indications, and limit the forms of application.

First of all, let me say, that there is a decided difference in the application, as well as the results where the radium element is used and where the emanations are used; also let me say that intensive radium treatment with one or two grams of radium element, does not enter into this discussion. Our results have been obtained, and what I have to say will apply to the man who has at his disposal from fifty to one hundred and fifty milligrams of radium element. The results which we have obtained can be had by the intelligent use of this amount.

While it is impressive to see the wonderful cures presented at the weekly conferences at the Memorial Hospital, these results have little clinical or practical bearing on the cases you and I will treat with our 100 or 150-milligrams of radium.

MYOPATHIC HEMORRHAGES IN YOUNG GIRLS

These bleedings are frequently excessive, some yield to the internal administration of endocrines and regulation of the lower bowel. When the bleeding has continued for any length of time, the endometrium becomes hypertrophied, and the uterus large and soft, and the os is very likely to be open. These cases were formerly curetted after all other forms of internal medication had failed, and a secondary anemia had been induced. After curetting there was usually an amenorrhea for a month or two, when this was again followed by metrorrhagia.

This same case treated by radium, for from 300 to 600 mgm. hours with the radium properly filtered with glass, silver and brass, and this covered with rubber, which practically cuts out all of the alpha and beta rays, will establish a normal menstruation after one seance. Once only have we had occasion to repeat the exposure. In this class there were 31 cases treated, the average dose was 400 mgm. hours, and only one application was given in 30 of this series. The results show that the quantity of the menstruation was regulated in every instance, except one, which required two subsequent applications. The last was followed by amenorrhea for one year, when the menses were re-established and recurred regularly. Six of these girls are now married, and two have become pregnant, a fact which answers some of the criticisms which are made of using radium in young girls.

RADIUM IN MYOMATA

Radium will control the hemorrhage of uterine myomata and in a large number of cases will reduce the size of the tumor provided the tumor is intramural or submucous and not pedunculated. Nevertheless, operation is still the procedure of choice in most myomata, for the indications for radium are limited and it has certain definite disadvantages, such as: First: While it controls bleeding, and in the majority of cases reduces the size of the tumor, nodules outside of the uterus may be left without a blood supply and consequently are more likely to give trouble.

Second: Malignant complications, already in the tumor, may be overlooked, for it has been shown that sarcoma is found in serial section in about 9% submucous tumors—consequently we can lay down the dictum that radium is never permissible in submucous growths or unless a diagnostic curettage is possible, for while remarkable results have been shown following radiation of cervical cancer, body carcinoma is not amenable to the effects of the rays.

Third: About 54% of all fibroids are complicated by some form of tubo-ovarian disease, consequently many of these intrapelvic complicating lesions are missed, and while the tumor is shrunk, and the hemorrhage controlled, the associated lesions help to keep up the patient's invalidism.

Fourth: Radiation, when applied in sufficient dosage to check hemorrhage and shrink the tumor, will seriously impair the reproductive functions in young women, and therefore should not be used as a procedure of choice in this class of cases.

Fifth: One of the symptoms of fibroid which requires treatment is the pressure symptom—here the effect of radium is too slow to relieve the conditions which intraligamentous growths produce on the ureters and blood vessels.

Sixth: The immediate effect of radium is the production of edema and excitation of inflammatory reaction; hence, in the presence of old inflammatory adnexal lesions, this reaction becomes more marked.

Finally: Radiation will increase the necrosis in tumors which are already necrotic, and by added acidosis increase the toxemia of the patient.

Against these disadvantages radium has certain definite advantages in the treatment of fibroid tumors, particularly if proper selection is made. These advantages are:

First: There is no operative mortality. There is no general anesthetic. There are no postoperative complications and there is prompt control of uterine hemorrhage.

Second: Should radium fail, operation is always possible.

Third: The menopausal symptoms are not so marked.

Fourth: In intramural tumors we can not only expect absolute cessation of the hemorrhage, but shrinking in the tumor is over 65% of the growths.

Fifth: Radium is the procedure of choice in myomata complicated by heart disease, extreme anemia, diabetes and chronic nephritis.

We have confined radiation in fibroids to those tumors which are not larger than a four months pregnancy, where the growth is definitely intramural, and there are no subperitoneal nodules of any considerable size; and to those submucous tumors which, after careful examination under anesthesia, are shown to be sessile.

In all we have treated 106 of these growths by radiation. These patients have had from 2000 to 3000 milligram hours; the radium element has been applied directly to the interior of the uterus, the alpha and beta rays have been excluded by proper filters. I have the follow-up records of all of these cases, and only two have needed subsequent operation; in these, both large submucous tumors, the bleeding recurred, and on operation it was found that the tumors had undergone a marked edema.

In 104 the bleeding ceased and has never recurred, after the first menstruation, which was more profuse in a number of instances than some of the previous bleedings. This, in turn, was followed by a serosanguinous discharge, which persisted for several weeks. In 80 of these tumors the growth had shrunken to less than half of the original size, and in 20 it has entirely disappeared.

The largest class of cases which come to us for relief are the bleedings resulting from subinvolution and fibrosis of the uterus without lateral or posterior parametritis, or a history of pelvic inflammation.

My associates and I have seen and applied radium to 260 women, who can be included in this class. There have been no failures to check the bleeding, and the majority of these uteri have, after a period of several months, become senile in character, and menopausal symptoms have appeared. Several in this class which were associated with prolapse have subsequently been operated upon, and the uterus interposed under the bladder with resulting cures of the descensus.

Stein, O. J.: Case of Nasal Sarcoma Cured by Radium.—*ractical Medicine Series* 3, 1918; *Ann. Otol. Rhinol & Laryngol.* ept., 1917.

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Nasal Sarcoma

Sarcoma entirely filled the right nares arising from the ethmoid cells.

TECHNIC.

One hundred milligrams of radium for 5 hours on 3 consecutive days. This dosage was on the 19th, 30th and the 60th days later. The total dosage was 4,100 mg. hrs. In addition 2,125 mg. hours were applied to the enlarged lymph glands.

RESULTS.

The immediate results were excellent. Pain and hemorrhage stopped at end of seven days. There was entire disappearance of the tumor and restoration of normal breathing. Perforative appendictis caused death four months later, but at the postmortem there was no evidence of sarcoma or metastases in the abdomen, nasal fossal, ethmoids or frontals.

Kohlmann, William, and Ernest C. Samuel. (New Orleans):
Radium Therapy in Fibroid and Other Benign Conditions of the Uterus.
Southern Medical Journal, Sept., 1921.

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Fibroids

"The method of preparation of the radium applicators that are being used at our clinic by Doctor Samuel and his associate, Dr. Bowie, has been to use the two mm. of silver. This is further enclosed in the celluloid containers with cotton packed on top and melted paraffin poured on top of the cotton, thereby sealing the container. Then the celluloid capsule receives a paraffin coating, which probably takes care of most of the beta rays. The method of sterilization is to put the whole applicator down in 40% formalin, allowing this to remain, with part of the white thread that is attached to the tube, for about ten minutes. It is then taken out and sterile water is poured over the applicator, after which it is put into sterile gauze until inserted. The element is packed in the very end of the applicator and not allowed to come in contact with the cervix. When more than 75 mg. are used, this is impossible, but this large amount is only used in desperate cases, when two or three applications with the ordinary amount have failed. The usual cleanliness that is used in all vaginal work prevails here. We do not use the retention catheter, as the liability of cystitis is always present, no matter how careful we are. After the introduction of the applicator a large vaginal pack is applied well against the cervix to hold the tube in position. The pack must not make the patient uncomfortable enough to prevent voiding. We do not allow the patient to sit up after the radium is in position. At the termination of the application the patient is instructed to take a douche night and morning of very hot saline. A watery discharge always follows and usually appears in about five days. This continues for about six months after the application and gradually subsides. For each subsequent application the same rules apply."

Amreich, I.: Combined Radiotherapy of Carcinoma of the Uterus. *Zentralblatt fur Gynakologie,* Leipsig. *Abst. in J. A. M. A.* Nov. 26, 1921. p. 1777.

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Uterus, Cancer

"Amreich surveys the results of this treatment as used in the First University Women's Hospital of Vienna in 1919 and 1920. He also describes the difference between their technic and that of Seitz and Wintz of Erlangen.

"They used a focal skin distance of 22 cm., 1 cm. less than that used by Seitz and Wintz. In applying irradiation, they use a localizing device which permits an exact centering of the tube and the exact measurement of the distance of the carcinoma area from the point of entry of the rays. They can thus determine what percentage of the surface dosage in a given case reaches the carcinoma and how many fields must be irradiated in order to reach the carcinoma region with a carcinoma dosage. The results were not so unfavorable, especially when it is considered that they were dealing, in the main, with inoperable cases that would otherwise have been beyond all aid. It is emphasized that the cures cannot as yet be regarded as permanent, as sufficient time has not elapsed; but the women are without subjective symptoms, have increased in weight, and no evidence of the presence of carcinoma can be demonstrated by inspection, manual exploration or examination of excised tissues."

Schmitz, Henry, (Chicago): The Treatment of Cancer of the us. *Jour. A. M. A.*, Aug. 20, 1921.

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Uterus, Canc

"The cancer patient coming to the physician for consultation usually suffers from the well known symptom triad: discharge, hemorrhage and pain—the discharge being the earliest, the hemorrhage the most alarming and the pain the most unfavorable symptom of cancer of the uterus. The occurrence of hemorrhage signifies an already advanced stage of the disease. The patient is willing to endure pain of quite a marked severity or to tolerate a discharge or even a marked odor, but the occurrence and persistence of hemorrhage will finally force her to seek medical advice.

"The examination of a victim of uterine cancer should have for its purpose the exact answer to the following questions:

1. Is the cancer clearly localized within the uterus?
2. Has it invaded the contiguous tissues and organs?
3. Has it involved the regional lymph nodes?
4. Has it formed metastases in distant organs and structures, such as the liver and the bones?
5. Do constitutional diseases, such as Bright's disease, diabetes, mellitus, decompensated heart lesions, complicate the uterine disease?

"The methods to be applied are bimanual vagino abdominal and recto-abdominal examinations, endoscopic examinations of the rectum and bladder, careful general physical and laboratory examinations. The results obtained will enable us to answer correctly the above mentioned five questions."

INDICATIONS FOR TREATMENT.

"Summarizing these facts, we may group the cases and formulate the indications for treatment thus:

Group 1. Cases which are clearly localized after a physical examination—the operable cases—are treated with an abdominal panhysterectomy.

Group 2. Cases which appear to be doubtfully localized after a physical examination—the borderline cases—and operable cases rendering a poor surgical risk, owing to complicating constitutional diseases, form the ideal group for radiation therapy.

Group 3. Cases in which a demonstrable invasion of the contiguous tissues and organs and regional lymph nodes is found on physical examination—the clearly inoperable cases—are subjected to an intensive radiation treatment.

Group 4. Cases so far advanced that all treatment seems hopeless—the terminal, desolate cases—are treated symptomatically.

Group 5. Recurrent local or regional cases are treated according to the same grouping and indications as stated under Groups 1 to 4.

Schmitz, Henry, (Chicago): **The Treatment of Cancer of the Uterus.** *Jour. A. M. A.*, Aug. 20, 1921.

SHEET NO. 2

TECHNIC.

"The technic of radiation treatment, therefore, consists in the combined use of roentgen and radium radiation. A solution of the problem is shown in Figure 2. It shows the intensity of measured rays at each point within the pelvis for roentgen rays. Also the isodoses of gamma rays measured with a 50 mg. radium element capsule within water, thus indicating the total primary and secondary radiations. The measured roentgen ray intensities also represent a summation of primary and secondary radiations. Table 1 indicates how unfavorably the summation of radiation becomes with an increase on the anteroposterior diameter above 18 cm. The greater diameters are found in obese and large boned women. To increase the radiation dose in such patients, we have of late applied roentgen rays through three portals of entry. The advantages thus gained are an increased roentgen ray intensity in the cancer area as demonstrated in Figure 3.

"Should radiation treatment be combined with surgical procedure to increase the efficiency of either one? It has been proposed to precede panhysterectomies for cancer of the uterus with radiation therapy, obviously to degenerate the cancer first and thereby render safer the surgical procedure. To apply radiation properly it is necessary to employ such an intensity of radiation that the periphery of the bony pelvis is struck with the same intensity as the region in the axis of the pelvis, that is, the cervix. Otherwise the peripheral cancer cells are stimulated to increased proliferation. Such a radiation treatment always causes a decided radiation sickness. During this period the patient could not be safely subjected to the additional trauma and shock of a capital surgical procedure. The operation must be postponed for from three to six weeks, during which time the patient will have recovered from the radiation toxemia. If the operation is performed within a few days after irradiation, the patient with an alarming frequency succumbs to sepsis and shock. Should the operation be postponed to a later period, the same danger is still present on account of necrosis of tissue in the cervical canal which cannot be avoided. These factors and the intense connective tissue formation in the parametrium, which renders hemostasis difficult, therefore do not let it appear advisable to resort to preoperative radiations. ...."

CONCLUSIONS.

The conclusions drawn from this study are:

1. Prophylaxis plays an important factor in the treatment of cancer.

2. Classification of uterine carcinomas is of paramount importance to separate localized from the more advanced cases.

3. Localized carcinomas must be treated by surgical methods, preferably with the use of the actual cautery, while the borderline and advanced cases should be referred to ray therapy.

4. A combination of surgery with radiotherapy is not advisable. However, a combination treatment of gamma and roentgen rays assures better results than the application of either agent alone. The radium must be inserted into the cervical canal, while the roentgen rays are applied through the suprapubic and sacral regions. This also renders the treatment available for all classes of patients, owing to the lessened expense.

5. It is hoped that with an improvement in the technic, permanent recoveries will become more numerous."

Clark, John G., and Floyd E. Keene: (Philadelphia): Irradiation in Cancer of the Female Genito-Urinary Organs. (Results in Three Hundred and Thirteen Cases). *Jour. A. M. A.*, Aug. 20, 1921, pp. 513-619. SHEET NO. 1	FILE UNI U Uterus, Cancer

Note:—This article should be thoroughly studied in its entirety.

"From time to time during the last five years we have recorded in the current medical periodicals our results from the treatment of cancer of the pelvic organs with radium, particularly of the uterus, and in these articles we have dwelt especially on the palliative effect of irradiation rather than to hazard a discussion as to the possibilities of ultimate cures, notwithstanding the justifiable hopes as to this outcome. We have maintained this position because of the skepticism which the world holds as to the settlement of this age-long quest for a dependable remedy for cancer. Today we may assert with positive assurance that even in the inoperable case of cancer of the cervix a surprising number, as reckoned by the quincennial test, have survived and are quite free from any demonstrable or symtomatic evidence of cancer. Those patients that are alive and well were registered in our clinic in the first years of our use of radium, while methods were largely in the proving ground, for we then knew little of the dangers and range of action of this occult force. In view of the fact that these cruder attempts have yielded a definite percentage of cures, we feel greatly encouraged; for with improvements in application and with a consequent lessening of bad sequelae, a decidedly better outcome may be forecast as these later series come up for review. In order that there should be no conflict in our report between the more recent and the older cases, we have included only those treated before August, 1920, thus leaving out of count the clinical product of the past year. Our report deals with a total of 313 cases; 112 of the patients are living and 201 dead."

METHOD OF TREATMENT.

"All of our patients have been subjected uniformly to 100 mg. of radium for twenty-four hours at the first application, and this dosage may therefore be considered as the standard to which we have adhered, with only an occasional exception in more than 400 cases treated up to date. We have purposely held to this standard because the primary results of our first 100 cases appeared to be so satisfactory in promoting relief of the chief symptoms of cancer that it seemed injudicious to change it radically. As several workers in irradiation have used different dosages, both as to quantity, duration of application, and repetitions of treatments, and since we are all in accord as to the primary palliative results, it seemed best for us to pursue in our clinic this course so that when we all assemble our reports in critical review, we may judge as to the best way of synchronizing methods and arriving at a uniform plan of action among those clinics in which the larger and smaller quantities are respectively available."

"Our plan through at least 150 cases was to apply 100 mg. contained within a glass capsule and this in a platinum tube, and this in turn enclosed in black rubber tubing, for twenty-four hours in immediate contact with the cervix, the healthy adjacent tissues being shielded from undue injury with lead protectors. After a six weeks' interval, this procedure was repeated. As to the results, we found that several patients sustained burns of sufficient intensity to cause

much irritability of the bladder, or an acute proctitis, occasionally causing pain from a mild and fleeting character to that of severe and persistent intensity. While this was by no means a uniform sequel, it occurred with sufficient frequency to be a decided disadvantage and a trying and discouraging ordeal for the patient. Added to this immediate effect came the later and much graver complication, an occasional vesical or rectal fistula, and these are always obstinate or even intractable to healing, either by operation or through the expectant policy."

"To remain contented with this adjustment of equations is, however, not our desire, and to obviate this very disabling accident, we have completely discarded all metal protectors in vaginal applicators, and instead we use a packing. For this suggestion we are indebted to Dr. Burnam. By far the larger number of fistulas date back to the period of lead protectors, but with our present plan we have much less apprehension as to this possible complication. Thus we mark as a first departure from our original standard of application the casting into the discard of metal protectors. A second, and we believe a very important conviction, we have arrived at through our experience. Here as in all other successful therapeutic methods, the rule of thumb is hazardous. By no acuteness of perception on our part, but through the apparent stupidity of a few patients who, regardless of grave warnings as to the dangers of procrastination, delayed reporting for a second treatment, we have discovered that in a considerable proportion of cases the lethal blow to cancer of the cervix is given by the first impact of the radium, and the question has arisen—do repeated applications make assurance doubly sure, or may they not occasionally jeopardize a successful issue?"

"We are not fully prepared to answer this query, but we are convinced that the routine repetition of treatments is injudicious without taking into full account the results of the first treatment. For instance, in one class of cases, in which the patients reported six weeks after the initial application, we find remarkable local healing in process of completion; in another the ulceration appears to be in status quo, while in a third no apparent beneficial effect is evident—on the contrary, a definite failure to hold in check the ulceration is obvious. In the occasional case, we believe that there is an actual acceleration of the growth. Thus of the 201 dead patients, fifty-nine had reached the end within six months after the application of radium, a frequent experience after radical operations........."

"Where there is a deep crater occupying the site of the lower uterine segment and extending out to the pelvic walls and backward and forward to the vesical and rectal walls, with grave cachexia and other evidence of metastasis, we may by this treatment actually render more wretched the few remaining weeks of existence of these patients. Also, when there are fixed pelvic masses extending out to the iliac walls, very seldom can anything be accomplished, for the destructive changes are too far removed from the focus of irradiation for even palliative measures. As we are not employing the emanation, we cannot speak as to results in these cases when the glass tubes are embedded in the malignant mass.

"In those cases in which a progressive favorable action is noted six weeks after the initial treatment, not infrequently the patient is advised to return again in six weeks, and if then we find hyaline cicatrix fully covering the site of the ulcer, we further delay action and may not see the patient again for six months."

"In the second class of cases in which no progress is noted, we usually make one more application and await the turn of events at the end of another six weeks interval. At that time should no progress be noted, further irradiation is abandoned, for we class such cases as hopeless."

"Within our knowledge, no favorable turn has been noted from a third application if the first two are unsuccessful. To repeat the treatments only adds to the patient's distress. Here, as is observed with any operation in the hopeless case, the remedy may be severely condemned, thus generating a prejudice among the friends or family of the patient, which may subsequently block its use in some other more favorable case."

"Another modification in our method of application deserves especial mention. In the first three years of our experience we were content to make the application without the aid of an anesthetic. A bit of tissue was snipped off or gently curretted away for confirmative diagnostic purposes, and the radium was then applied, usually with the patient in the knee-breast or Sims' posture. Under these conditions it was frequently difficult to adjust the radium tube accurately to the affected area. In applying the metallic vaginal shields or, as in later cases, the gauze pack, the tube might shift and thus cause trouble. To obviate these dangers and to be certain of a complete orientation at the first sitting, nitrous oxid anesthesia is administered. If there is a large cauliflower mass it is excised by the cautery. By this procedure, radium may be brought one or more inches nearer the crucial area, thus securing full contact and avoiding the rapidly lessening effect of the intensive irradiation as the distance is increased."

"Further, when possible we always insert a 50 mg. tube within the cervix and a cross contact tube of equal quantity in the cervical crater or vaginal vault. Not infrequently a superficial conelike incision is made with the cautery, avoiding a deep penetration into healthy tissues and the radium tubes are enclosed within this cup with fine catgut sutures. At a six weeks' interval, a second catgut application of 100 mg. is made in the vaginal vault.

RADIUM NEEDLES.

"As to the use of radium needles, our experience is as yet too limited to warrant any positive assertion as to their value in cervical cases, but we anticipate a betterment of statistics from this source of deeper irradiation. Since cancer extends by the broad and utosacral ligaments, we not infrequently insert four needles of about 13 mg.

each into these structures. Obviously the danger of injuring the rectum or perforating Douglas' culdesac attends the penetration of the uterosacral ligaments, while the ureters or uterine vessels are jeopardized in the broad ligaments. Through the guidance of the needle with one finger in the rectum and directing the needle slightly posteriorly and outward in the broad ligaments, these dangers may largely be obviated. At least, thus far we have had no unhappy encounters of this nature."

TECHNIC OF APPLICATION

"Patients are prepared as usual for gas anesthesia, a hypodermic of morphin, one-fourth grain, and atropin sulphate 1/150 preceding the operation by one-half hour. The patient is prepared as for a plastic operation on the cervix, care being observed not to traumatize unduly the carcinomatous area in the cleansing process. Then a complex examination by vagina and rectum is made in order to determine the extent and character of the growth. If there is a cauliflower mass it is removed by the cautery and not the curet. Too much stress cannot be laid on the dangers of harsh manipulative use of the curet, or excision of tissue with the scalpel in the advanced cases. When there is a crater, we never use the curet or even the cautery. When the case is of the cauliflower type, the superficial mass is removed only down to the cancer base in order to reduce the distance to the frontier zone of infiltration. The cervical canal is dilated if it is discoverable, and the first tube of 50 mg. of radium salt in black rubber tubing is inserted into the uterus. On the vaginal portion of the cervix or within the crater a similar tube is held by fine catgut sutures. If it is desirable to employ the needles, they are inserted into the appropriate areas, as described above, not more than 1 inch in the broad ligaments and approximately 1½ inches in the uterosacral ligaments. It is necessary to make this maneuver more or less blindly, the sense of touch being our only guide. The Lee type of needle is used, screwed to a staff about 3 inches in length. The posterior vaginal wall is retracted well back from the cancerous area with a long Sims' speculum, likewise the anterior vaginal wall toward the symphysis. Thus the posterior vaginal wall and rectum may be pushed 1 inch or more back toward the hollow of the sacrum, and the vesical wall is removed almost as far from harmful effects. This we consider a capital method for preventing an irradiation proctitis or cystitis, with the attendant hazards of fistulas."

"In cancer of the fundus we always incline even in advanced cases to operation. In this connection, we simply reiterate what has been said in previous articles:

"In cancer of the cervix, when in doubt, always irradiate; in cancer of the fundus, when in doubt, operate." However, in cancer of the fundus, when there are grave contraindications to surgical intervention, we turn to radium with great hope when the case is within reasonable limits. In our list of 313 cases there have been only twenty-three cases of cancer of the fundus. Of these, twelve patients survive from three to six years without objective symptoms or

demonstrable lesions. The remainder are below a three-year limitation but are in excellent health. In eleven cases which were far advanced when treatment was given, the patients are dead but, there were none of these within the potentialities of the most daring surgeon."

CONCLUSIONS.

1. Radium in 100 mg. amounts will yield most gratifying results if properly applied.

2. To pursue a set course without variation in the frequency of treatments, regardless of the progress of the healing, is hazardous.

3. To attain the best results, the first irradiation should be done under nitrous oxid anesthesia, as a more careful examination may be made and the radium more advantageously brought in contact with the malignant areas, either through radium tubes or by radium needles. Guaze packing instead of metal shields should be used for protective purposes.

4. The process of cure passes through three stages: Local destruction, connective tissue formation and hyalinization.

5. A hysterectomy after successful irradiation of an otherwise inoperable case is hazardous and does not promote the best interests of the patient.

6. Results of irradiation in cancer of the cervix practically remove this class of cases from the surgical field, although we have not yet completely yielded this point.

7. Cases of cancer of the fundus, unless too far advanced, or unless there is a critical surgical contraindication should be submitted to hysterectomy, followed from fourteen to twenty-one days later by a light irradiation of the vaginal fornix.

8. Irradiation is dangerous immediately before or soon after an operation, or when employed in fresh operative fields.

9. Frequent repetitions of irradiations are probably unnecessary and possibly hazardous, as the foregoing observations point to the fact that the chief blow is struck at the first application.

10. The frequency of irradiation fistulas may be reduced to a minimum or almost completely avoided by the application of a well placed vaginal pack which removes the healthy tissues from the zone of intensive emanations.

Clark, John G., and Floyd E. Keene: (Philadelphia): **Irradiation**
Cancer of the Female Genito-Urinary Organs. (Results in Three
undred and Thirteen Cases). *Jour. A. M. A.*, Aug. 20, 1921, pp.
3-619.

SHEET NO. 6

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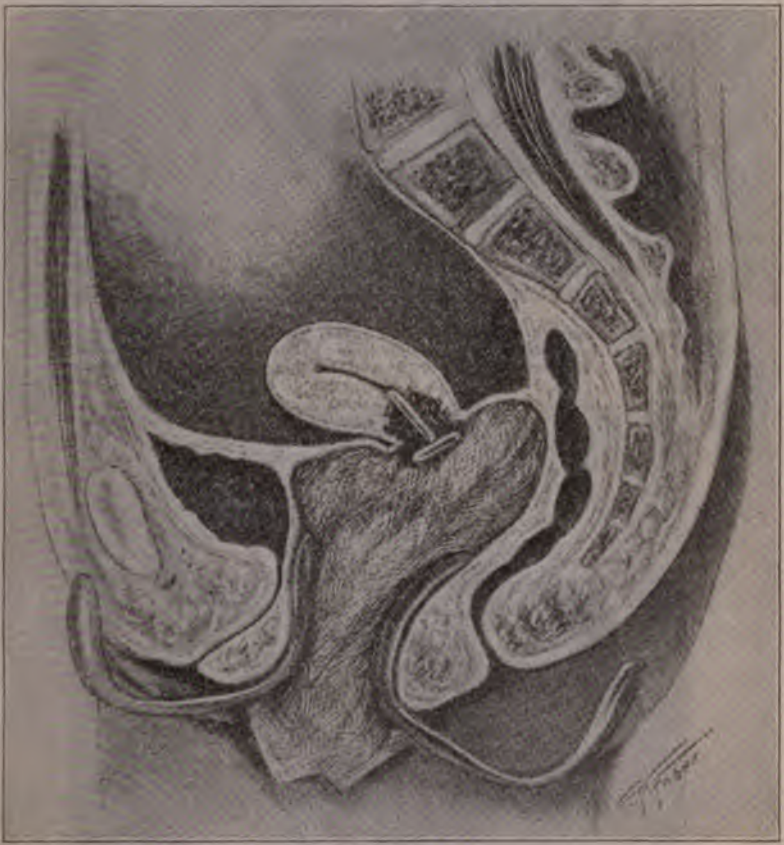
Uterus, Cancer of



Voluminous gauze packing placed with the aid of Sims' specula in such a way as to press the rectovaginal wall backward and the vesicovaginal wall forward out of harmful contact.

Clark, John G., and Floyd E. Keene: (Philadelphia): **Irradiation Cancer of the Female Genito-Urinary Organs.** (Results in Three ndred and Thirteen Cases). *Jour. A. M. A.*, Aug. 20, 1921, pp. 3-619.

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Uterus, Cancer of

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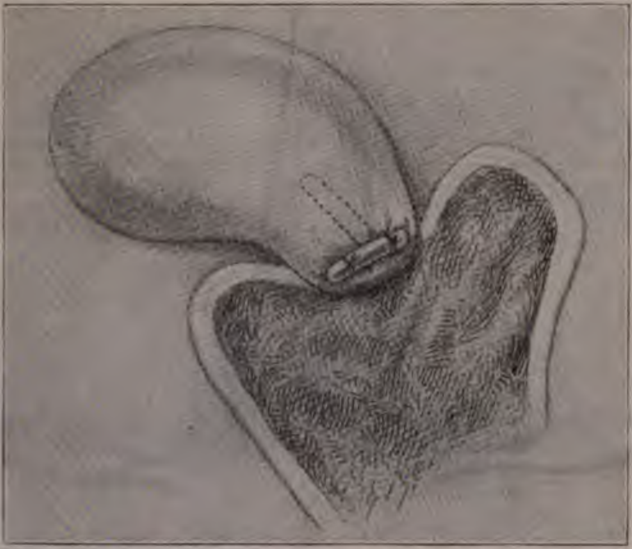
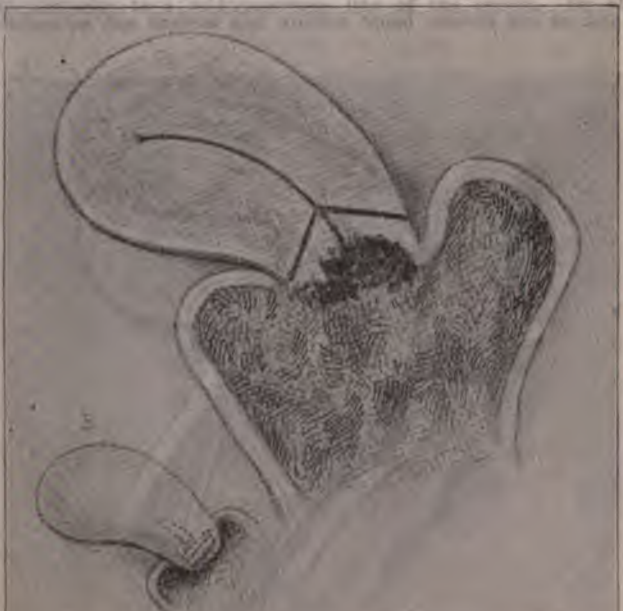


In the usual case without cauliflower excresence, one tube is inserted within the canal and a second held in crosswise contact held with a fine catgut suture.



Area of excision with the cautery knife marked with triangular converging lines. After this cervical cone is removed, one 50 mg. tube is inserted in the cervix and a second is placed crosswise within the crater. The two flaps may then be closed with fine catgut sutures, thus holding the tubes in a secure place where their maximum force may *safely* be expende

Clark, John G., and Floyd E. Keene: (Philadelphia): **Irradiation**
Cancer of the Female Genito-Urinary Organs. (Results in Three
undred and Thirteen Cases). *Jour. A. M. A.*, Aug. 20, 1921, pp.
13-619.

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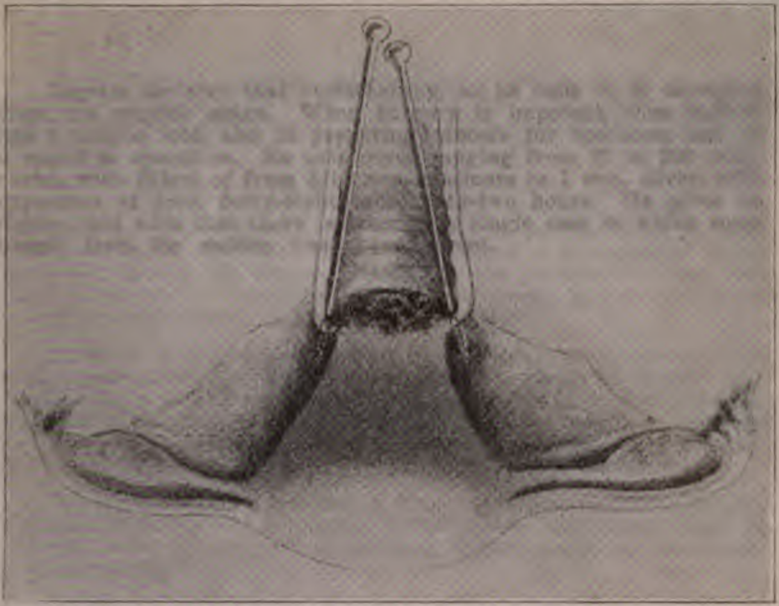
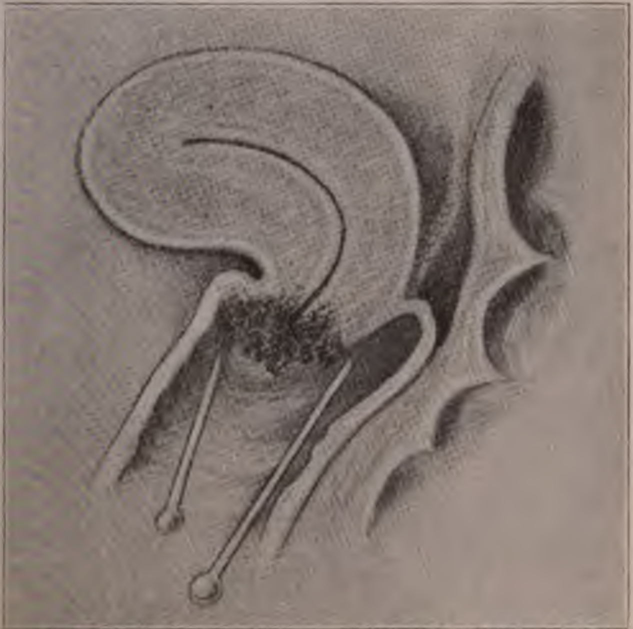
Uterus, Cancer of

SHEET NO. 8



Radium needles inserted about 1 inch into the parametrium. In introducing these needles a point is selected lateral to the cervix and slightly posterior to a midtransverse line of the cervix. By observing this precaution the ureters and uterine blood vessels are in less hazard.



Lateral view of needles inserted in the sacral and broad ligaments.

Degrais, P., Paris.: Cancer of the Cervix, Archives Mens.— ***d'Obstetrique et de Gynecologie***, Paris, November, 1919. 8, No. 11, ***Journal of American Medical Association***, February 7, 1920, p. 425.

FILE UNDE
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Cancer of Cervix

Degrais declares that curietherapy, as he calls it, is emerging from the empiric stage. When surgery is impotent, then radium has a unique role, also in preparing cancers for operation and as a sequel to operation. He uses doses ranging from 27 to 200 millicuries, with filters of from 3/10 mm. platinum to 1 mm. silver, with exposures of from forty-eight to seventy-two hours. He gives no figures, but adds that there is scarcely a single case in which some benefit from the radium was not apparent.

Baisch, K.: The Results of Radium Treatment of Carcinoma of the Uterus.—(Erfolge der Radiumbehandlung des Uteruscarcinomas). *Strahlentherapie*, 1920, X, 36. Abstracted in *Surgery, Gynecology and Obstetrics*, October, 1920; p. 312.

FILE UND
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Carcinoma-Uterine

In 66 cases of genital cancers treated with radium and mesothorium in 1914 there were 42 cancers of the cervix. Seven of these patients are still alive (16 per cent, the same percentage as following operation).

Baisch classifies these cases into the following groups: (1) beginning cancer of the cervix, 3 cases; (2) advanced cancer of the cervix without involvement of the vagina and parametrium, 12 cases (complete cures were obtained in only 2, and a rectovaginal fistula developed in 1); (3) cancer infiltrating the parametrium but still operable, 5 cases (1 complete cure; 20 per cent); and entirely inoperable cancers, 21 cases (2 cures; 10 per cent).

From 50 to 100 mg. of radium in a brass capsule covered with rubber were applied for twenty-four hours at intervals of three or four weeks. As a rule the treatment consisted of three or four sessions. Because of the development of many rectovaginal fistulæ at first, the use of 1 cm. of wax to protect the rectum was begun later and since the only 1 rectovaginal fistula has developed in 360 cases treated.

The author recommends radium treatment alone only in beginning and inoperable cases of carcinoma of the uterus. All others should be operated upon and given three series of radium and X-ray treatments postoperatively.

Beclere, A. (Paris): Radiotherapy of Uterine Fibromyomas.—*Journal de Radiologie*, Paris, July, 1920.

FILE UNDE
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Uterine
Fibromyomas

Becleres' article is a reply to the question asked by the Societe de Chirurgie whether the treatment of uterine fibromas should be handed over by the surgeons to the radiologists. His conclusion is: "Quite legitimately, the treatment of fibromas is now passing from the surgeons to medical radiologists, and from year to year will pass thus in increasing proportions.

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Beclere, A. (Paris): Radiotherapy of Uterine Fibromyomas.—
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Taussig, Fred J., St. Louis: In What Cases Do Uterine Fibroids
ll Require Operative Removal. Jour. A. M. A., July 10, 1921.

FILE UN
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Fibroids, Ut

CONTRAINDICATIONS TO RADIOTHERAPY

"1. Size. When the mass of the fibroid uterus is more than 12 cm. in its average diameter, operation is usually to be preferred. I think it better to employ this form of description rather than the distance of the tumor above the symphysis, since a relatively small uterus may be situated high and reach almost to the navel, whereas a large fibroid filling the whole pelvis may barely be felt from above.

"2. Location—Submucous fibroids protruding through the cervix, subserous fibroids of considerable size with a definite pedicle, cervical fibroids and intraligamentous fibroids had better be operated on. I do not, however, agree with Zweifel in excluding fibroids that are merely pressing against the rectum or bladder, provided they are not already partly wedged into the pelvis. In several instances I have seen such pressure symptoms complétely disappear after the shrinkage produced by the radiation.

"3. Degeneration—Rapidly growing tumors, calcified fibroids, necrotic fibroids and those complicated with malignancy are not suitable for radiation.

"4. Age.—There is no absolute contraindication to radiation on account of age except so far as the desire for children or a preservation of menstruation makes myomectomy or subtotal removal of the body of the uterus preferable.

"5. Complications—Pyosalpinx and ovarian cysts except small retention cysts, are a positive contraindication in my opinion. Often we encounter difficulty in differentiating between a laterally situated fibroid that is somewhat adherent and an adnexed mass. It is well not to be in too great a hurry. In those cases in which there is still a reasonable doubt, I would prefer operation to radiation, for it will take many more reports than those of Van de Velde to convince me that radium treatment of pyosalpinx is anything more than a very dangerous experiment.

"Such in the main are the contraindications to radiation. It is evident that only the careful diagnostician will be able to differentiate between the cases that are suitable for operation and those that are suitable for radiation. It is therefore, greatly to be deplored if the general practitioner should, without further consultation, send all his fibroid patients to the roentgenologist for treatment, or even worse, if the roentgenologist should undertake the treatment of fibroids with roentgen ray before a careful pelvic examination by some competent person has been made."

Clark, J. G.: The Relative Values of Radium and Surgery in the Treatment of Tumors of the Pelvic Organs.—*Annals of Surgery*, 1920, LXXI, 683. Abstracted in *Surgery, Gynecology and Obstetrics*, October, 1920.

SHEET No. 1

FILE UN
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Fibroid—
Hemorrh

Clark gives a very clear statement of the position occupied by radium as compared with surgery in the treatment of tumors of the pelvic organs.

Radium, he believes, may be considered "an adjunct of surgery and not its competitor."

In giving his experience based upon five years' use of radium, the author divides his work into that which relates to fibroids of the uterus, to "idiopathic bleeding uteri" with no apparent tumefaction within the uterus, and to cancer of the uterus. In the first class of cases 50 mg. are used as a rule and all uncomplicated tumors up to the size of a three-and-a-half to four months' pregnancy are radiated. Tumors larger than this should be removed by hysterectomy. The dose of 50 mg. may be repeated once or twice at intervals of four, five, or six weeks. Usually one treatment of 50 mg. for twenty-four hours will stop the bleeding within a period varying from a few days to four weeks.

Great care must be exercised in the selection of cases for radium treatment. There must be no acute or chronic pelvic inflammation and no cystic tumors of the ovaries. Radiation in the presence of an old chronic pelvic inflammation is a dangerous procedure.

In cases of idiopathic bleeding—menopause cases—radium works like a miracle. One treatment of 50 mg. for twenty-four hours checks the bleeding forthwith and is rarely followed by recurrence.

Of the author's series of 150 cases belonging to the groups mentioned 4 were not relieved of bleeding by radiation and were later treated by hysterectomy with no untoward complications.

Radium should be employed for young women less frequently than for women at or near the menopause age as in the former a simple myomectomy or a subtotal hysterectomy which leaves the generative organs essentially normal may be possible and the physiologic equilibrium after an operation is more stable. Also in the cases of young women radium must be used in much smaller doses than for older women or castration may result.

The author is especially enthusiastic regarding the use of radium in cases of cancer of the uterus, particularly in operable cancer. He and his associates have treated 209 cases of inoperable cancer with the following results:

Year	Dead	Not Living	Living
1914	8	0	1
1915	19	1	4
1916	46	8	11
1917	33	3	23
1918	5	13	34
Totals	111	25	73

Clark, J. G.: The Relative Values of Radium and Surgery in the Treatment of Tumors of the Pelvic Organs.—*Annals of Surgery*, 1920, LXXI, 683. Abstracted in *Surgery, Gynecology and Obstetrics*, October, 1920.

SHEET No. 2

FILE UN

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Fibroid—
Hemorrha

The author's conclusions may be summarized as follows:

1. Radium as a palliative remedy is the treatment par excellence in inoperable cancer of the cervix.

2. In inoperable cancer of the cervix radical operation should be done and followed immediately by postoperative radiation.

3. In cancer of the fundus uteri hysterectomy is indicated unless grave contra-indications to operation are present. When operation is contra-indicated radium should be used.

As yet, the author is not able to report any cures, but he ventures the belief that some of the patients will live at least five years.

Stacy, Leda J., Rochester, Minn.: Radium Treatment in 600 Cases of Menorrhagia.—*American Journal of Roentgenology*, August, 1920; pp. 379-382.

SHEET No. 1

FILE UNDE
U
Hemorrhage

"We have now the roentgen rays and radium as definitely recognized therapeutic agents. * * *

"It has been our policy to limit the use of radium to fibroids the size of a three and a half to four months' pregnancy, unless there is a definite contraindication to operation. * * *

"Of the series of 600 patients with menorrhagia with or without uterine myomas treated with radium at the Clinic from July, 1915 to January, 1920, 438 have been heard from. Sixty-nine of these were married women under 35. Normal full term pregnancies occurred in 3 patients: two were women of 22 who had been given two tubes of 25 mg. radium of 4 hours each: the other, aged 26 had been given 25 mg. for 9 hours. One patient aged 31, with small multiple fibroids was given two 25 mg. tubes of 6 hours and the periods became regular and normal; three years later she gave birth to a normally developed full term dead child. Menstruation again became profuse two months after confinement and 4 months later 350 mg. hours were given. Two days after the treatment the patient developed a rapid pulse and evidence of shock, without rise in temperature or evidence of peritonitis, and died 12 days later. This is the only death in our series and has not been satisfactorily explained. One woman gave birth to a premature dead fetus after receiving 23 mg. radium for 10 hours, and another woman gave birth to a premature deformed fetus, after receiving 50 mg. for 6 hours. One woman of 37 who had 250 mg. hours had 2 miscarriages at 3 and 6 months. One woman of 25, after 25 mg. for 10 hours, is now 6 months pregnant. One woman aged 30, who had had 25 mg. radium for 10 hours was questionably pregnant at the time she reported.

"In the treatment of menorrhagia in patients more than 35 who have a fibrous uterus or a small myoma and in younger patients in whom myomectomy or hysterectomy is not indicated or in whom curettement has not controlled the menorrhagia, radium is a very satisfactory therapeutic agent. Radium should not be used, however, for patients who give a clinical history or present physical signs of pelvic infection or of pyometritis, nor for those who complain of chronic pelvic pain, since the application of radium might light up a quiescent infection. We have had 3 cases in which operation was done because of the infection after the application of radium, in one in 5 weeks, in one in 6 weeks, and in one in 3 months.

"In our series of 600 cases were 122 women under 35; 19 were 25 or under. Eighty-nine were heard from. The average dose of radium given to these patients was 293 mg. hours. Menorrhagia was controlled by one treatment in 55.6 per cent; a second treatment was necessary to control the menstruation in 17 cases. In 25 the periods were reported normal in amount, in 11 irregular and scant, and in 6 menstruation ceased; 3 of these patients, aged 28, 30 and 34 respectively, had 300 mg. hours. Hysterectomy was performed later in 6 patients; one patient aged 32 was operated on 8 months after receiving 400 mg. radium hours without improvement; one aged 30 was operated on one year after receiving 375 mg. hours treatment without improvement; one aged 28 was operated on after one year because of pelvic pain, although the profuse flow had not returned; one aged 31 was operated on after receiving 200 mg. hours treatment

without relief; and one aged 27 (a case of hemophilia and myoma) was given 300 mg. hours treatment, then transfused and given 400 mg. hours. Menstrual periods were regular for 8 months, followed by continuous flowing for five weeks, when the hysterectomy was performed. One girl of 16 was given 100 mg. hours one year after a curettement with only temporary improvement; the flowing was more or less continuous, and two years and 9 months after the radium treatment a hysterectomy was performed; adenocarcinoma of the fundus was found. Abdominal myomectomy was performed in 7 patients who received only temporary benefit following the radium treatment; 2 of these had had radium treatment a second time. We attempt to give the women under 35 enough radium to control the symptoms, but not enough to stop menstruation, and it is difficult to judge the amount necessary in each case. It is better to give a small dose, however, and if there is a recurrence of the profuse flow, repeat the dose in three, 4 or 6 months, than to give enough at the first treatment to stop menstruation.

"Patients more than 35 are given larger initial doses, as it is not so important that menstruation shall continue. We have tried, however, to give a dose to all patients under 40 which will control rather than stop menstruation. We have seldom given more than 50 mg. for 14 hours at one treatment, since we believe that it is better to repeat the treatment if necessary, as it is sometimes in cases of fairly large tumor. There are 478 patients more than 35, and of this number 349 have been heard from. In 81 (23.2) per cent of these the examination showed the uterus to be "fibrous" or not large. In 220 cases the uterus was graded on a scale of 1, 2, 3, 4 or the fibroids graded 1, and in 29 the fibroids were graded 2 or 3. Thus in the large percentage of cases the treatment was confined to the smaller tumors and the large doses given by many physicians were not used.

"In the series of 349 patients it was necessary to repeat the treatment in 64, and an operation was done later in 20. Only 4 of the 20 were given a second radium treatment, and 2 had operations elsewhere too soon after treatment to obtain the effect of the radium. Menstruation became regular and normal in 39 (11.17 per cent).

"Of the patients more than 40, 263 were heard from; in 185 (70.35 per cent) of these menstruation had ceased. Only 14 of this group were given 2 treatments; 4 were given the 2 treatments close together; the other 10 received the second treatment after from one month to one year. In the larger percentage of those cases in which menstruation ceased there were two periods following the treatment before the cessation.

"Improvement in general health was reported in 231 cases, and gain in weight in 157 cases. No improvement was reported in sixty-eight.

TECHNIC.

"Our technic has not varied materially from that which I described, in a paper published in 1918,* except that we now use either the emanation or the radium element, and are using slightly larger doses for older persons, but usually not more than 700 mg. hours. If this

is not sufficient we prefer to repeat the treatment in a few weeks or months.

CONCLUSIONS.

1. In young women with fibroids causing menorrhagia radium should be used only in carefully selected cases and in small amounts in the initial treatment.

2. Pregnancy may occur after the application of radium, but in a small percentage of cases only.

3. Abdominal myomectomy is preferable to radium in the treatment of women under thirty-five who have definite fibroids causing menorrhagia.

4. Radium is the ideal treatment for menorrhagia in patients more than thirty-five who have a fibrous type of uterus, and for patients who have small fibroids and menorrhagia.

5. In cases in which the history is suggestive of carcinoma of the fundus an abdominal hysterectomy is the safer procedure, and should be advised even if the diagnostic curettement is negative for malignancy.

6. Unless there is a definite contraindication we believe that large fibroids should be treated surgically because of the possibility that degenerative changes may occur in a tumor in which the blood supply has been interfered with and because of the possibility of a mistaken diagnosis.

*—The following is the Technic referred to by Dr. Stacy:
(This is taken from the paper "*The Treatment of Menorrhagia with Radium*"—published in the *Collected Papers of the Mayo Clinic*, X, 1918.)

The technic used by us is similar to that in use elsewhere. The patient is given a cleansing douche, the cervix is drawn down by a tenaculum forceps, swabbed with tincture of iodin and gently dilated and the radium is inserted into the uterine canal. The radium element is encased in a glass tube within a silver tube 0.5 mm thick, and this in turn is inclosed in a rubber tube 0.5 mm. in thickness. This screening is sufficient to filter out the alpha and the soft beta rays which produce the local irritation. A narrow strip of plain gauze is carried into the cervix and the vagina is packed.

The patient is allowed to leave the hospital a few hours after the radium is removed. She keeps off her feet for the following 24 hours. If there has been a recent hemorrhage, or if the treatment is given during the menstrual flow, the patient remains is bed until the flow ceases. Usually the flow at the first period after the treatment is as profuse as usual, or it may be increased in amount. The reason for this is not definitely known. It may be because of the local hyperemia of the endometrium, produced by the beta rays, or it may be due to the liberation of the ovarian hormone by the destruction of the corpora lutea.

Stacy, Leda J., Rochester, Minn.: Radium Treatment in 600 Cases f Menorrhagia.—*American Journal of Roentgenology,* August, 1920; p. 379-382.

SHEET NO. 4

FILE UNDE
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Hemorrhage

"In the majority of patients more that forty-five years, and in all of which there is intermenstrual bleeding, a diagnostic curettement is done previous to the radium treatment. If the clinical history is at all suggestive of a carcinoma of the fundus, a hysterectomy is done, for even a very thorough curettement may fail to reveal a carcinomatous focus.

"The dosage of radium is gaged by the age of the patient and by the presence or absence of a tumor. In a young person without a demonstrable tumor, and when it is desirable to continue menstruation, usually one application of 50 mg. of radium element from four to six hours (200 to 300 mg. hours radium) is used. In older persons in whom it is desirable entirely to stop menstruation it has been found that an exposure of 50 mg. for from ten to twelve hours has brought about the desired results. In cases in which large dosage is used menstruation is usually irregular for about two months and ceases entirely after the second or third month; following the lighter exposures it becomes regular and normal in most instances in about two months. It is our custom not to repeat the treatment until an interval of three months has elapsed. If, after that time, menorrhagia continues, a second treatment is given, and, with the exception of one case, the second treatment has been effective. In this instance menstruation ceased for one year, and then became profuse and the periods prolonged. It has been necessary to give a second treatment in 10 instances in this series. In 8 instances a hysterectomy was done later; 1 elsewhere one month after the radium treatment. One only of these 8 patients had been given a second radium treatment."

Van de Velde, T. H.: Radiotherapy in Adnexitis—*Zentralblatt fur Gynakologie,* Leipzig. Sept. 4, 1920. Vol. 44, No. 36.

FILE UND
U
Uterine
Hemorrhage

Van de Velde contends that in every case of oophoritis, as soon as it appears that it will not run a light course, temporary sterilization of the ovaries by graduated irradiation is indicated. Roentgen rays and radium influence menstruation in much the same manner; radium, however, does not cause hemorrhages through irritation, and it seems to stay hemorrhage more quickly than the roentgen rays. Experience shows that irradiation does not exert a harmful effect on later conceptions. Injury to the surrounding organs and tissues occurs only through over dosage. For combating hemorrhage in cases of oophoritis with menorrhagia or metrorrhagia that do not yield to medical treatment. Van de Velde reports using 50 mg. of radium in an oblong tube; filter 1 mm. of silver; 1.5 mm. of nickeled brass, 1 cm. of cotton and a thin rubber covering. (The size of this dose makes it more than probable that he is using radium bromide which is 53.6 of radium element). The tube is inserted with great care across the posterior fornix or is placed against the os, packed around with tampons. No inflamed and sensitive spot should be irradiated and the radium should be kept as far away from the rectum as possible. The patient must lie as quiet as possible during the treatment. The radium remains in place 12 hours. Three or four applications are given, always followed by 12 hr. intervals. Thus from 1800 to 2400 milligram hours are applied. He advises this temporary ray castration without waiting too long, and lauds the benefit in many cases from this suspension of ovarian functioning for several months to a year and a half, restoring the woman to active life, with the gradual return of normal menstruation without injurious by-effects.

Mayo, W. J.: Conservation of the Menstrual Function.—*Journal of American Medical Association*, 1920, LXXIV, 1685. Abstracted in *Surgery, Gynecology and Obstetrics*, October, 1920; p. 315.

FILE UND
U

Menstrual Function

In selected cases radium must justly be considered a competitor of hysterectomy, but it has no competitive standing in cases suitable for myomectomy. When bleeding necessitates interference in the menopause period, radium has a remarkable field of usefulness. If the tumors are large, coming well up into the abdomen, and are caused to disappear by the use of radium, the menopause is brought about. Massive doses of radium usually destroy the function of the ovaries and uterus; the non-functioning organs are left to await an uncertain future. Non-operation and conservation must be differentiated.

Janeway, Henry H.: The Treatment of Uterine Cancer by Radium.—*Surg., Gyn and Obstet*, XXIX., 242-245, September, 1919. *Radium*, November, 1919.

FILE U
U

Fundus
Carcinoma

Case histories of four cases: Two improved for periods of two years; two clinically cured, 14 and 21 months after treatment.

TREATMENT.

Radium tubes and emanation tubes were either embedded in the mass or applied within the cervical canal.

TECHNIC.

The tubes were inclosed in a 1 millimeter platinum or lead filter covered with rubber, the rubber being 1.5 millimeter in thickness.

DOSAGE.

The average dosage in these cases was 1481 millicurie hours with extremes from 1170 millicurie hours to 2015 millicurie hours.

LATER HISTORY.

An old lady died of intercurrent disease two years after the radium treatment. She never had any return of her uterine symptoms. A second patient remained in perfect health for two years from the time of her first treatment. The third patient treated one and one-half years ago and the fourth patient treated within the past year are still free from symptoms.

Clarke, John G., and Keene, Floyd E.: Radiation in Inoperable Cases of Carcinoma in the Female Genito-Urinary Organs.—*American Journal of Roentgenology,* Vol. VII., pp. 36-41, January, 1920. *Radium,* May, 1920.

FILE U

U

Genito-Urin

Presents results of 209 cases inoperable cancer of the cervix treated since 1918 in Gynecological Department of the University Hospital.

TREATMENT.

One hundred milligrams applied at one sitting and repeated at a second interval six or eight weeks later. If no improvement is noted after second sitting we make no further application, as we have seen no improvement accrue from a third treatment when the two preceding have failed.

TECHNIC.

The silver or platinum radium containers are encased in black rubber drainage tubing, carefully tied at both ends. The site of the cancer must be exposed with one or two Syms specula, as necessity demands. Usually a gauze tampon which forms a buffer between the rectum and the cancerous area is carefully applied and upon this the radium tubes rest transversely to the axis of the vagina. Above, the radium gauze is further packed to protect the bladder, followed by a liberal but not uncomfortable gauze tampon within the vagina. Frequently the vaginal vault may be much more expeditiously exposed by placing the patient in the Syms' or knee-breast posture. Indeed, in some instances, the latter posture greatly facilitates the more accurate placing of the radium tubes. The patient usually remains in the hospital two or three days.

RESULTS.

From our summary of 209 cases, we find no cause for discouragement, for we have seen splendid palliative results from radiation, and we hope that with a further development of technique, cancer of the cervix may be removed from the surgical domain.

Curtis, Arthur H.: Chronic Leukorrhea: Its Pathology and Treatment.—*Journal of American Medical Association*, **June 19, 1920, pp. 1706-1710.**

SHEET 2

FILE UND
U

Leukorrhea

Experience thus far indicates that the pathologic changes in most cases are within reach of radium. The present plan is to discontinue the use of a double gold screen, replacing it with a single rubber covered gold capsule, not over one mm. in thickness. Short applications made at intervals of not less than ten weeks, permit observation of the effects of each treatment. Even in repeatedly treated stubborn cases it is thus possible to avoid production of premature menopause. Whether it will often be necessary to discontinue treatment before cure is effected remains to be determined.

It is my opinion that radium in amounts small enough not to disturb menstruation is not to be feared as a cause of sterility. On the other hand, it will probably not be especially beneficial in the relief of sterility because a large percentage of patients with cervix infection have already suffered from catarrhal salpingitis. Two exceptions have been encountered: A patient of Dr. Watkins who had not been pregnant for five years, complained of sterility. Conception developed within three months after relief of a cervical catarrh through an application of 500 millicuries of radium. The other patient received 925 millicuries. She is now pregnant and expects to be confined in two months.

CONCLUSIONS.

Chronic leukorrhea of cervical origin is, in most instances, amenable to cure through dilatation of strictures and treatment with small doses of radium applied at infrequent intervals. The prognosis is less favorable in those cases with chronic cellulitis or uncorrected gross pelvic lesions.

Curtis, Arthur H.: Chronic Leukorrhea: Its Pathology and Treatment.—*Journal of American Medical Association*, June 19, 1920, pp. 1706-1710.

SHEET 1

TREATMENT.

The patients have been subjected to a thorough pelvic examination, the reaction of the discharge tested, smears obtained from the cervix and vagina and a set of cultures made. Gross pathologic lesions are corrected surgically. The usual hygienic measures are instituted.

The most usual and most difficult focus to eradicate lies in the endocervix. Unless the discharge is essentially of vulvovaginal origin, radium is advocated in all severe cases of persistent chronic leukorrhea. After thorough dilatation, the cervix and fundus may be curetted for diagnostic puposes.

DOSAGE.

Fifty mgs. of radium, preferably two 25 mg. tubes in tandem, are introduced high into the cervix, held by a suture passed through the external os, and left for several hours. One or more subsequent radium treatments of shorter duration may be required.

It is thought best to plan on an interval of from ten to twelve days' duration between applications.

Each radium tube employed in the treatment of this series of cases has been screened by a double gold capsule with a total thickness of two mm. The capsule in turn has been incased in dental rubber. At present the screen has been reduced to a single rubber covered gold capsule of one millimetre. The duration of application has been correspondingly decreased.

COMMENT.

Of 36 patients available for thorough treatment, 30 received radium and 20 were sugjected to destruction of Skenes ducts. Twenty-five recovered, seven were distinctly improved, the result in one was doubtful, and three were not materially benefited.

Menopause was produced in two patients. One of these, 39 years of age, with scanty menstruation at the time of radium treatment, received 500 milligram hours. The other patient, with one remaining, partly diseased ovary, received 700 milligram hours.

Sufficient radium, distinctly to influence ovarian activity was given to three patients, each of whom received three treatments at infrequent intervals. Symptoms of impending amenorrhea in these three patients were characterized by greatly increased irregular menstruation, with associated nervousness and tendency to occasional flushes. All returned to symptomatically normal condition within three months.

Stacy, Leda J., M. D., Mayo Clinic, Rochester, Minn.: The Treatment of Menorrhagia With Radium.—*Minnesota Medicine*, Vol. II., 88-92, March, 1919. *Radium*, April, 1919.

FILE UN

U

Menorrhagia

TECHNIC.

Similar to that in use elsewhere.

In a young person without a demonstrable tumor and when it is desired to continue menstruation usually one application of 50 mg. of radium element from 4 to 6 hours (200 to 300 mg. hrs. radium) is used. In older persons in whom it is desirable to stop menstruation 50 mg. used from 10 to 12 hrs. has accomplished the result. In cases in which the larger dosage is used menstruation is usually irregular for about 2 months and ceases entirely after the second or third month. Following the lighter dose it becomes regular and normal in about two months.

No repeat treatment given until after a 3 month interval.

Matas, Rudolph (New Orleans): Radium Therapy.—*Amer. Jour. of Roent.* Sept. 1920, pp. 440-46.

FILE UNDE
U

Metrorrhagia

Reports experience with 78 cases of metrorrhagia treated with radium.

Fibromyomata caused 64 of these. Fourteen were of the so-called "essential type" (non-neoplastic).

The majority were married women, and the greater proportion were within the reproductive age. Conception had not appeared in any case during the four years following the use of radium.

In metrorrorhagia of puberty or of the menopause, where granular metritis or other endometrial pathology appears, radium is recommended when the standard treatments fail.

Mayo, W. J.: Conservation of the Menstrual Function.—
ournal of American Medical Association, June 19, 1920.

FILE UNDE
U

Menstrual
Function

RADIUM FOR FIBROIDS.

* * * Radium may justly be considered, in selected cases, a competitor of hysterectomy, but it has no competitive standing in cases suitable for myomectomy. When bleeding necessitates interference in the menopause period, radium has a remarkable field of usefulness. If the tumors are large, coming well up into the abdomen, and are caused to disappear by radium, the menopause is brought about. Massive doses of radium usually destroy the function of the ovaries and uterus, leaving these non-functioning organs to await an uncertain future. We must sharply distinguish between non-operation and conservation. * * * *

Janeway, Henry H.: The Treatment of Uterine Cancer by dium.—*Surgery,Gynecology and Obstetrics*, Vol. XXIX., 242-245, eptember, 1919. *Radium*, November, 1919.

FILE UNDE
U

Uterine

"The dosage which I have found sufficient in cancer of the cervix, the radium being distributed as described as 6,000 millicuries, i. e., divided into 3,000 millicurie hours, within the uterus and 3,000 millicurie hours against the cervix, in other words, it is recommended that the radium should be divided into six tubes for the treatment of cervical cancer, and if each tube contains 50 mg. three of the tubes arranged end to end are placed in the utero-cervical canal for 20 hours, and the other three against the cervical ulcer for the same length of time.

"We recommend the use of 20 to 30 or 40 millicuries of emanation according to the size of the tumor treated, distributed as evenly as possible throughout the tumor. Bagg has shown one millicurie will produce a general necratic effect through a sphere of tissue surrounding the tube for a distance of one cc. It is important therefore, that the amount of emanation in each tube should be reduced to a minimum consistent with the avoidance of objectionable trauma, dependent on the introduction of too many tubes. The dose from 20 to 40 millicuries of emanation is 2640 to 5480 millicurie hours."

Pinch, A. E. Hayward, London: A Report of the Work Carried Out at the Radium Institute, London.—*Annual Report for* **1918.** ***Radium,*** **August, 1919.**

FILE UND
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Uterus

The menorrhagia and metrorrhagia, which are the usual concomitants of this condition, are almost invariably checked, sometimes completely abolished, by radium treatment. Some diminution in the size of the existing tumor may also be produced, but this result is not always obtained.

DOSAGE*

Prolonged exposures of thirty hours duration are given, a 100-mg. tube, screened with 2 mm. of lead and 3 mm. of rubber, being placed within the uterus—or in the posterior fornix—if this be impracticable—supplemented with a plate of equal strength screened in similar fashion, and applied over the fundus.

TECHNIC.

In many instances one such series of exposures proves effective, in others two, three or four series may need to be given at intervals of not less than four months.

The most suitable cases for treatment are those in which the patient is over forty years of age—so that the establishment of a premature menopause is not a matter of any very great moment—and the tumor is of moderate size, and not the site of any inflammatory or degenerative changes.

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*It must be borne in mind that in this Report the dosage is reported in terms of pure crystalline radium bromide, which is a salt containing 53.6 per cent. of radium element. Since radium element is the standard used in this country, it is necessary to multiply the figures given in the Report by the factor 0.536 in order to express results in terms of radium element.

Janeway, Henry H.: The Treatment of Uterine Cancer by Radium.—*Surg. Gyn. and Obstet.*, Vol. XXIX, 242-245, September, 1919. *Radium*, November, 1919.

FILE UND

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Uterine Cancer

Case histories of 17 (bordering operability) carcinoma of the cervix: 12 clinically cured to date three and one-half years to six months after treatment.

TREATMENT.

The treatment consisted in the application of radium emanation tubes within the cervical canal and against the cervix.

TECHNIC.

These glass emanation tubes, unfiltered, were either embedded in the mass, or used with 1 millimetre platinum tubes, or with 0.5 millimetre silver tubes.

These silver or platinum tubes were always inclosed within rubber tubing. This tubing was 1 and 1.5 millimetre thick.

DOSAGE.

The average dosage in these cases was 3134 millicurie hours, with extremes from 232 millicurie hours to 6311 millicurie hours.

THE FIVE NON-SUCCESSFUL CASES.

In two of these a large portion of the vaginal wall was involved. Two others had bad symptoms of bleeding for many months before the radium treatment. The remaining case had a very advanced lesion.

Clarke, John G., Philadelphia, Pa.: Results Obtained by the Use of Radium in the Treatment of Cancer of the Uterus.—*Annals of Surgery*, LXIV., 602-612, November, 1916.

FILE UNDI
U
Uterus Cancer

Cites work of Schauta as enlightening as to what radium will do.

In Schauta's first series of 13 cases, 50 to 100 mm. of radium were employed uninterruptedly for from 3 to 11 days and repeated after an interval of from 12 to 22 days. His results were disastrous.

In the third series of 11 cases, from 30 to 50 mg. filtered through 1.1 mm. of gold, 1 mm. of platinum and 0.75 mm. of brass were applied in from 5 to 8 exposures of 12 hours each at intervals of from 1 to several days; an interval of rest of 3 or 4 weeks was then allowed to elapse, followed by a second or shorter exposure, and in some cases, after another interval of two or three weeks, a third series was given.

Of the eleven patients thus treated, 3 were somewhat improved, and the remaining 8 were apparently cured.

Donaldson, C. O., M.D. and G. E. Knappenberger, M. D. (Kansas ity, Mo.): Radium in the Uterine Cancer. Southern Medical Jour., arch, 1922, pp. 224-229.

FILE UNDE

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Uterine cance

Applied 50-mgm. radium screened with 0.5 mm. silver and 1 mm. brass. Usually heavy rubber is put over brass capsule but if it is not possible to insert this package within cervical canal without trauma, the rubber is removed. Many times 25-mgm. is inserted within the cervical canal and 25-mgm. is placed across the cervix in the shape of a "T." This amount is left in place 24 hours if patient is comfortable. If necessary it is removed at end of 12 hours. If 24 hour application is made, three to four such treatments are given with 24 hour interval between. The amount of radiation will depend upon the extent of the disease, the size of the vagina and the patient's ability to take treatment. On an average 3500 to 4000 mgm. hrs. are given within one week. Before applying the radium the lower bowel is cleansed with soapsuds enema; a sodium bicarbonate douche given and during the application the bladder is emptied at least every three hours. The sodium bicarbonate douche is repeated after removing radium.

The patient is kept under observation for two weeks and instructed to exercise very little. If any reaction occurs such as bladder or rectal irritation, the patient is requested to remain in bed until symptoms are gone. Rarely is it necessary to resort to medicine to relieve pain. Routine examination of the pelvis, including vagina and rectum is made at intervals of two months following treatment. Occasionally a small recurrence can be satisfactorily treated. However, nearly all such recurrences are more resistant to successful treatment and some are found that have not responded to a second application. Therefore the necessity is seen for giving a reasonably large dose in a short period of time, making an effort to deliver a lethal dose before the cancer cell has had time to develop an immunity to radiation.

Ransohoff, J. Louis: Late Results of the Radium Treatment of Cancer of the Uterus.—*Journal of American Medical Association,* January, 1920.

FILE UNDE

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Uterus, Cancer

The Wertheim operation which was considered a step forward, is still on trial after two decades. Contrasted with the high mortality following extensive operations for uterine cancer, there is practically no immediate mortality from radium treatment, and it is available for all classes of cases at all stages of the disease. The immediate results have been good without exception in the author's observation. After two years absence in the army service, he found that of the patients he had seen in the three years prior to his absence numbering 32 in all, 19 per cent were well and free from all evidence of disease from nearly three to five years after the treatment. In two cases of cancer of the body of the uterus the results were disappointing. Neither of these cases, however, were operable. Deducting the eight cases in which incomplete series of treatments were given, there was 25 per cent relief of symptoms during this period and in no definitely operable case was the treatment unsuccessful. He says, "We have here 19% of those patients treated from recurrence for from two and one-half to five and one-half years; one patient for five and one-half years; two patients for over four years; one patient for three years, and one for two and a half years. The latter case may perhaps be a little too recent to be definitely called cured. This percentage of cure may seem small but it compares favorably with that following operation. Deducting the eight cases in which the treatment was incomplete, raises the percentage to 25." If cases were chosen for radium treatment with the same care that they are chosen for operative treatment, Ransohoff thinks the percentage of cures would be very much larger. There is scarcely any case so advanced that some improvement cannot be made. Radium treatment is not in itself fatal while the direct mortality from operation is over 18 per cent.

Werner: **"Influence of Deep Radium and X-ray Treatment on the rocess of Reproduction."** Abstracted in *The American Journal of bstetrics and Gynecology*, September 1922, No. 3, page 332, from *uenchener Medisiniche Wochenschrift*, June 24, 1921, p. 767.

SHEET NO. 1

FILE UNDI
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Reproduction
and Radiation

NOTES.

Writers seem to agree that deep radiation does not inhibit the power of conception, does not disturb parturition, and does not predispose to abortion or premature labor.

Much more uncertainty exists in regard to the fate of the offspring of women who have been rayed. Doederlein and later Kroenig pointed out the danger of partly damaged ova becoming impregnated and giving rise to varying degrees of monstrosities. This was further strengthened by the experimental work of Hertwig who rayed spermatozoa and non-impregnated as well as impregnated ova directly. Fraenkel applying this to human was able to demonstrate a constant general under-development as a result. On the other hand Nuernberg's more recent investigations point to just the opposite conclusion. He concludes that some ova are so badly damaged in the ovary that they cannot continue to develop, while others are not changed at all, and so may give rise to a normal fetus. Such ova as may be only partly damaged and might give rise to monstrosities escape our observation, probably by leading to very early abortion.

RESULTS.

The author presents the results obtained in a series of 1512 cases treated by radium or x-ray for essential metrorrhagia (990) and myomata uteri (552). Out of this series 24 pregnancies subsequently occurred. Of these, 13 resulted in full term pregnancy with living child, 1 in four weeks premature labor, 9 in abortion from the second to the fifth month, and one pregnancy was terminated by removal of the myomatous uterus.

Two of the full-term pregnancies with living babies, three of the abortion cases and the case of interrupted pregnancy (hysterectomy) had become pregnant after an amenorrhea lasting for several months produced by x-ray or radium treatment. The remaining pregnancies occurred in women who, under treatment, had reached a stage of oligomenorrhea.

Not counting the interrupted pregnancy (hysterectomy) 14 of the 23 cases ended with delivery of living child while 9 aborted. Of the 9 abortions, 3 were induced, 6 were spontaneous; this leaves a proportion of 2.3 births to one abortion while the relation in Germany is as 5:1.

All labors were normal as were the puerperal periods. Eclampsia developed in one case during labor. Early pregnancy was also normal.

The new born children were normal in appearance and negative to examinations. Of the 14 babies born alive, 4 have since died. The premature died in 8 hours of general weakness, the other three of intercurrent disease—pneumonia, bronchitis and measles at 9,

10 and 15 months. The remaining 10 have been carefully observed. They range in ages from 2 months to 8 years. Six of these (2 months to 3 years) seem normally developed physically and mentally, 4 are between 6 and 8 years, 3 of these in spite of exceptionally good initial development became deficient in the 4th and 5th year in weight and length to an extent which can be expressed as 16 per cent and 8 per cent respectively when compared with the normal. They are even yet one kilogram underweight, and one is 8 cm. below normal in height. All of these children have an ample diet.

In two further cases treatment was continued after pregnancy had originated. This first woman became pregnant after the first treatment and the condition not being diagnosed the treatment was repeated 3 times. In the second case with a mistaken diagnosis of myoma uteri 4 intra-vaginal treatments off 30-40 mg. of radium for 24 hours each were given. The first woman went to full term, delivered normally of living child fully developed and apparently entirely normal.

The second woman went overtime 4 weeks and delivered of an under-developed baby, 45 cm. long, 1950 grams and manifestly undernourished. The first baby now 6 years old is 3 kilograms underweight; the second baby—3¾ years—is about one year behind normal in its development.

CONCLUSIONS.

In general, the author concludes, pregnancy can occur after x-ray and radium treatment of dosages in vogue, even when the stage of amenorrhea has been reached and in neither the course of pregnancy nor in labor is any special danger to be anticipated. A definite tendency to abort seems to exist in these cases. While the new-born presents no apparent damage or mal-development, later on, development appears to be retarded.

**Gellhorn, George, M.D.: "When to Operate and When to Use Ra-
um on Fibroids of the Uterus."** Abstracted in *The American Jour-
l of Obstetrics and Gynecology,* September, 1922, No. 3, page 330,
om *Journal of the American Medical Association,* 1922, lxxviii, 259.

FILE UND
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Fibroids of the Uterus

NOTES.

Gellhorn feels that the principal field for radium is in women over 40 who have fibroids not extending to the umbilicus. It is further indicated in those who are, for some reason, poor operative risks and those who object to any form of operation.

According to the statistics of Gauss and Friederich, the hemorrhage is controlled in 98.4 per cent and there is more or less shrinkage of the tumor in 70 to 80 per cent of the cases radiated. Gellhorn believes that the rays have a direct destructive action on the tumor cells, as mere castration would not cause the rapid shrinkage observed in some cases.

All tumors extending above the umbilicus and all large pedunculated subserous and submucous fibroids should be operated on, as well as all cervical fibroids. Suppurating, necrotic and gangrenous fibroids are unsuitable for radiation, as well as those undergoing cystic or calcareous degeneration. Co-existing adnexal disease is an indication for surgery. Gellhorn feels that radiotherapy is justified in cases of sarcomatous degeneration, provided the dose is correspondingly large.

TREATMENT.

The success in the use of radium depends upon the proper selection of cases. Gellhorn prefers radium to x-rays, but occasionally uses the two in combination. Ordinarily he employes 1200 mg. hours within the uterine cavity. This treatment he administers preferably after the menstrual period. While calling attention to the absence of any operative mortality, which is from 3 to 5 per cent, he admits that he has found it applcable in only about 60 per cent of the cases coming under his care.

Kupferberg, Dr. H.: "Radium Therapy of Benign Uterine Hem-
rrhage." Abstracted in the *Journal of Radiology*, February, 1923,
age 78, from *Fortschr. a. d. Geb. d. Roentgenstrahlen*, 29, June, 1922.

FILE UNI
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Uterine
Hemorrhage

NOTES.

The author has used radium element for intra-uterine applications since 1914. Four hundred and fifty cases were irradiated, of which 338 were myomata and 122 were metropathies.

TECHNIQUE.

After careful disinfection the cervix is dilated and 50 mgs. of radium element filtered with 1.5 mm. brass, 1.0 silver, or 0.8 mm. gold introduced into cavity. Sometimes introduction into the cervix or even into the vagina is sufficient.

DOSAGE.

To produce peprmanent amenorrhea 1,800 to 2,000 mg. hours are required. Less duration gives only temporary amenorrhea.

RESULTS.

In 43 young women there was marked shrinkage of the myomata, with menstruation after one year. Six of them gave birth to healthy children subsequently.

INDICATIONS.

Menorrhagia, metrorrhagia, juvenile and climacteric menstruation, myomata below the level of the navel, stubbon cervical catarrh, osteomalacia, inflammatory tumors of the adnexa, and for artificial sterilization.

CONTRAINDICATIONS.

Myomata having undergone softening, and submucous myomata. Where malignancy is suspected, 4,800 mgm. hours should be given. In cases of inflammatory tumors of the adnexa, the application must always be intravaginal.

ACTION OF RAYS.

The action of radiation is not directly on the ovarian tissue, but secondarily through the endometrium and myometrium.

SEQUELAE.

There often occurs a bloody discharge. Atrophy of the myomata is accompanied in 60 per cent of cases with atrophy of the follicular apparatus and of the endometrium. There is no atresia, there is no disturbance of the libido, and no shrinkage of the vagina. False passage avoided by careful technique.

Newell, Dr. E. T.: "Radium in the Treatment of Menorrhagia ith Case Reports of Forty Successful Cases." Abstracted in the *ournal of Radiology*, February, 1923, page 73, from *J. Tennessee . A.*, 14:266, October, 1922.

FILE UND

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Menorrhagia

GENERAL NOTES.

This study includes only the cases of hemorrhage due to hyperplastic endometritis of long standing. The treatment in such cases is so effective that other methods need not be considered. The discussion does not include cases of hemorrhage due to fibroid tumors, polyps, malignancies, infections, etc. Patients are divided into two groups, those at or near the menopause and younger patients (20 to 35), the treatment differing materially in technique. In young women under 35, the radium is introduced directly into the cervical canal and uterus without preliminary dilation and without previous curettage. Fifty milligrams are inserted and left four to eight hours. Treatment is repeated only if the following menstrual flow is excessive, the dosage being less at the second application. In cases at or near the menopause, dilatation and curettage should be done on account of a possible malignancy, the radium being applied at the time of curettage, and the time of application lengthened in order to establish the menopause more promptly. If the scrapings are found to be malignant, radium in appropriate doses or surgical procedures, as indicated, should be followed. Several case reports are given.

FILE UN	Newell, Dr. E. T.: "Radium in the Treatment of Menorrhagia with Case Reports of Forty Successful Cases." Abstracted in the Journal of Radiology, February, 1923, page 73, from J. Tennessee M. A., 14:286, October, 1922.
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Duncan, Dr. Rex: "Treatment of Uterine Cancer." Abstracted the *Journal of Radiology*, February, 1923, from *Texas State J. ed.*, 17:366, November, 1922.

FILE UNDE
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Uterine Cancer

NOTES.

The results of surgical treatment are graphically shown by the figures of January, who tabulated the results of 6,000 cases reported by the surgeons of this country and Europe. These results show that, for every 100 patients presenting themselves for surgical treatment, 60 must be turned away without treatment; of the 40 who are operated on, 18 per cent, or 7 patients, die as the result of the operation; 8 patients will be cured and the remaining 25 will have a recurrence. The 60 who are turned away, the 7 who die from the operation and the 25 who have recurrences, leave only 8 per cent who are cured, and 92 out of each 100 patients are doomed unless some other method than surgery comes to their relief.

TECHNIQUE.

The rapid progress in radium therapy in uterine cancer, and the more recent addition of high voltage x-ray therapy offer good reasons for believing that this mortality can be lessened. The present procedure is somewhat as follows: During a hospital period of from five to seven days, the patient is given a total of 6,000 to 10,000 millicurie hours. After the local reaction has subsided, in from six to eight weeks, she is given a thorough radiation with high voltage x-rays.

RESULTS.

In a total of 300 patients treated, more than two years ago, there are 122, or 40 per cent, who are clinically well for periods ranging from two to seven years. Of these, 99, or 36.4 per cent are clinically well.

Stenger: "Pregnancy and Birth after X-ray Treatment of the
yomatous Uterus." Abstracted in *The American Journal of Obstet-*
es and Gynecology, September, 1922, No. 3, page 334, from *Schweiz-*
ische Medizinische Wochenschrift, 1921, ii, 1084.

FILE UNDE

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Pregnancy after Radiation

GENERAL CONSIDERATION.

The question is raised as to whether children, normal in physical and mental development may be born to a mother with a myomatous uterus after extensive x-ray treatment for the myoma. The author cites cases where apparently healthy children were born after the uterus had been treated for myomata almost as large as a fetal head and the myomata had disappeared. The explanation offered is that probably impregnation had taken place before treatment or close to it or else that some of the primordial follicles were immune to the dosage used either intrinsically, or that they were buried more deeply in the ovary and were not reached. He suggests that amenorrhea may come on a month or two before actual sterilization has taken place. In the event of other complications such as Basedow's disease the dosage may be varied so that actual sterilization does not take place and this opens up the possibility of temporary sterilization in such conditions as pulmonary tuberculosis, mental diseases or kidney affections. If the patient be already pregnant there is no definite reason to expect either an abortion or an imperfectly formed child. Apparently the best time to attempt temporary sterilization is in the first half of the intermenstrual period and the treatment to be at a single sitting. The methods are too uncertain as yet to be able to determine the length of such temporary sterility.

Werner: "A Contribution to our Knowledge of the Generative 'rocesses after Radium and Roentgen Deep Therapy." Abstracted in *'he American Journal of Roentgenology and Radium Therapy*, Janu-ry 1923, page 82, from *Munchen. med. Wchnschr.*, 1921, No. 25.

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Effect on Generative Processes

SUMMARY.

Out of 1,500 women treated by radiation for metrorrhagia or myomata, 17 became pregnant several of them repeatedly, so that altogether, 24 cases of pregnancy after irradiation were observed. There were 9 abortions (3 of these were unquestionably induced), 14 normal births, and one total extirpation of the uterus on account of myoma. Six women, who for many months had become amenorrheic owing to irradiation, became pregnant again; in other cases there resulted only oligomenorrhea. Of the 14 children born alive, 4 died, one immediately after birth, 3 at the age of one year from pneumonia or measles. The other children were under permanent observation. Of these, 3, which are now 6 or 8 years old, are 16 per cent below the normal in weight and 8 per cent below the normal in height. Two other cases were irradiated during pregnancy; in the first case, 4 roentgen irradiations were given; the child is normally developed; in the other case, there have been 4 treatments intravaginally with 30 to 50 mg. radium bromide, each treatment lasting twenty-four hours. The child, which was born at term, weighed only 2 kg. and was lacking in fat; its skin was pale yellow; it is now three years old; in height and weight it corresponds to two years, but it is otherwise healthy. Irradiation of the ovum or of the embryo may, therefore cause injury which, however, can be followed by extensive improvement in the course of later development.

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Stacy, Dr. Leda J. "The Treatment of Benign Conditions of the
lvis with Radium." Abstracted in the *Journal of Radiology*, Janu-
ry, 1923, page 30, from the *American J. Roentgenol.*, 9:658, October,
922.

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Benign
Conditions

SUMMARY OF TREATMENT.

Dr. Stacy of the Mayo Clinic believes that radium " is the treatment of choice in cases of menorrhagia of menopause associated with fibromyomas not exceeding in size a four months' pregnancy, of or a fibrous uterus, in which the possibility of malignancy is eliminated by the history or by a curettement. Small doses of radium are indicated in a few carefully selected cases of menorrhagia in young women of the child-bearing age. A history or evidence of pelvic infection is a contraindication to the use of radium. In adenomyomas which are adherent and difficult to remove, the use of radium is preferable to surgery. Treatment with radium relieves the symptoms in certain cases of pruritus vulvae and in kraurosis associated with pruritus. Endocervicitis continuing after an abdominal hysterectomy responds satisfactorily to one or two treatments with radium.

Heyman, Dr. James: **Results of Radium Therapy in Climacteric
morrhage.** Abstracted in the *Journal of Radiology*, January 1923,
ge 31, from *Institute of Radium, Stockholm, Acta Radiologica*,
70, August, 1922.

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Climacteric
Hemorrhage

SUMMARY OF TREATMENT.

The following is a translation of the author's own summary of this article:

From 1916 to 1921 there have been treated at the Institute of Radium at Stockholm, 49 cases of uncomplicated climacteric hemorrhage. All were treated by radium. Only one treatment was given in 41 of these cases, 30 were intrauterine and 11 were vaginal applications. In seven cases two treatments were given and in one case three were given.

Results: Amenorrhea was produced in 32 cases and oligomenorrhea in 16 cases. One case was unsuccessful.

Ross, J. N. MacB. and Rolleston, H. D.: Asthma and Radium **Menopause.** Abstracted in *The American Journal of Obstetrics and Gynæcology,* September, 1922, page 332, from *The British Medical Journal,* January 7, 1922, 12-13.

FILE UND
U

Menopause a
Radiation

CONCLUSIONS.

The authors in a short article, including the citation of some cases, draw the following conclusions:

1. One application of radium may bring on the menopause and may be substituted for operative procedure.

2. The method may cause distress and even dangerous results.

3. Ovarian extract should be given to counteract unpleasant symptoms from the sudden menopause.

4. They advise the use of ovarian extract in illness at the time of menopause which is probably due to ovarian insufficiency.

5. Asthma may be due to deficiency of the internal secretion. Ovarian extract is occasionally beneficial.

Gilbert, William Henry, M. D. (Los Angeles): Uterine Myomata nd their Treatment. ***California State Journal of Medicine*****, January, 923, No. 1, page 7.**

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Uterine Myo

Most gynecologists believe that the woman under 40 is not a fit subject for radiation because of the destruction of the sex glands and the premature production of the menopause. I believe this to be true irrespective of the size of the tumor. In a general way we can say that the field for radiotherapy is the woman over 40 who has fibroids which do not extend to within three inches of the umbilicus. The uterus studded with myomatous growths and very irregular in outline is not a fit subject for radiation. The more uniform the uterine enlargement the better it is adapted to this treatment. The class of cases designated as poor surgical risks are many times better treated by radiotherapy. I refer to cases of marked secondary anaemia in the woman over 40. Prolonged bleeding many times has reduced the hemoglobin to 20 or 25 per cent and made the surgical risk very high. Then again, the woman with cardiac or renal disease and high blood pressure had best be treated by radium or X-ray. The very stout woman or the woman with tuberculosis, either pulmonary or renal, should be treated surgically. All tumors extending to the umbilicus or above, as well as pedunculated fibroids should not be rayed, but treated surgically. This is also true of infected or suppurating tumors and those that are necrotic or gangrenous. Cystic or calcareous degeneration is another indication for surgery. Fibroids complicated ovarian tumors or infection of the tubes should not be treated by radiotherapy. Rapidly growing fibroids in the woman over 40 should best be treated by radium because of the very likely possibility of sarcomatous degeneration.

My own personal experience in the use of surgery in sarcoma has been anything but gratifying and I am inclined to the belief that radium holds out more hope than surgery.

One of the hardest questions to decide is to the method of choice in fibroids complicated by carcinoma of the body of the uterus. Of fibroids complicated by carcinoma of the cervix, there is but one method of treatment that holds out any ray of hope and it is in radium. I hardly think at the present time I would operate carcinoma of the cervix whether it was complicated by fibroids or not, but of carcinoma of the body I am inclined to believe I would make a radical hysterectomy and follow it by long and deep X-ray treatments of very high voltage.

Another class I desire to refer to is where the tumor is incarcerated in the pelvic cavity and it enroaches upon the bladder and rectum. The broad ligaments in these cases are almost completely obliterated and it is a difficult matter to adjust clamps so as to control hemorrhages. Here I have seen considerable shrinkage and one case a cure effected by the use of X-ray.

Practically all cervical fibroids should be removed surgically.

Matthews, Harvey B., M. D., F. A. C. S., (Brooklyn, N. Y.): **Ra-**
dium in Non-malignant Uterine Bleeding. *The Medical Times*, Jan-
ary, 1923, 12-23.

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Uterine Blee

INDICATIONS AND LIMITATIONS

As experience with the use of radium has increased, its indications and limitations are gradually becoming better understood. It is now certain that in practically 100 per cent of the cases of uterine bleeding of non-malignant origin, where there is no complicating pelvic pathology, that the bleeding can be controlled by the judicious use of radium. (Clark & Keene, J. A. M. A.; 79; Aug. 12, 1922; 546; Frank. W. VA. Med. Jour.; 16; May, 1922; 432; Matthews, H. B., N. Y. State Jour. Med.; 22 Dec., 1922). It constitutes, in fact, the treatment of election in a large proportion of these cases, and while radium should not entirely supplant surgery in the management of non-malignant uterine bleeding, I do not hesitate to state that hysterectomy or other more or less mutilating operation is absolutely contra-indicated in the uncomplicated straight-forward cases of intractable uterine bleeding due to small fibroids, myomas, fibrosis uteri, chronic metritis and the so-called myopathic, idiopathic or essential forms of uterine bleeding. If these statements are true, it would seem that very gynecologist and every general surgeon doing gynecology should have access to sufficient radium, say 100 to 150 mg., to carry out this form of treatment. Furthermore, it must be apparent that such treatment to be successful, requires that the selection of cases suitable for radiation remain in the hands of those who have had special training in gynecological diagnosis as well as radium therapy. The indiscriminate intra-uterine use of radium cannot be too strongly condemned, in as much as such practice can only bring discredit to a very valuable therapeutic agent.

Bailey, H., and H. J. Bagg (New York): Vulval and Vaginal Cancer Treated by Filtered and Unfiltered Radium Emanation. Amer. Jour. of Obstetrics and Gynecology. Dec., 1921, Vol. 2, No. 6. Abst. in J. A. M. A. Jan. 14, 1921, p. 145.

FILE UND

V

Cancer, Vulv

"Bailey and Bagg state positively that the original lesion in vulval cancer may be eliminated completely without loss of any considerable amount of normal tissue and with comparatively little pain by the use of imbedded radium emanations. Wherever possible, the radium tubes surrounding the lesion are inserted through normal tissue. The imbedded radium produces a prolonged gradual, reactive inflammation which is effective in checking the extension of the disease. The experience with various doses of unfiltered radium emanation has shown that if the tubes are of 5 mc. strength, the elimination of the tumor is associated with extensive sloughing and prolonged and serious discomfort. Whereas the smaller dose of about 0.5 mc. accomplishes as much for the removal of the growth, and yet without sloughing and with little pain. Except in the most minute lesion it is not possible to arrange the placing of the tubes so that all the cancer cells are effectively radiated. Filtered radium to further check the growth of the injured, or partly damaged cells, is necessary as an adjunct to the implantation of bare tubes in vulval and vaginal cancers."

Degrais, Dr. P. (Paris): Curietherapy (Radiumtherapy) In Vulvar Vegetations During Pregnancy. Published in the Canadian Practitioner, February, 1922, pp. 47-49.

SHEET 1

FILE UND

V

Vegetations, Vulval

TECHNIQUE.

The method of treatment differs accordingly as the affected areas are vulvar or vaginal.

VULVAR VEGETATIONS.

In these conditions we use flat, glazed applicators. To many these applicators may have nothing but a pre-historic interest, but nevertheless, they are indispensable in the equipment of the Curietherapist, although many doctors consider that the only radium treatment of value is obtained from the use of tube, and, especially of needles. Certainly the handling of flat applicators requires much skill, for, in them, the radium is naked and one gets the benefit of all the rays without the constant screen which is present in the casing of the tubes and needles. For this screen absorbs as much of the radium rays as 3.2% of the beta rays which are considered useless, because of their causticity. But this is not true any more of beta rays than of gamma rays. The greater number of the former and their weaker penetration are such that an error in dosage results in superficial phenomena, which bring discredit to the rays, while the fault really lies in the fact that the dose has been wrongly apportioned. It is for this reason that we emphasize the fact that the use of beta rays requires more skill and more experience than the use of gamma rays. The whole thing is a question of the dose, time of exposure, and also the inherent sensitiveness of tissues which differ widely in different regions.

Those arguments which urge disfavor of the practicability of the use of glazed applicators are not in any way sufficient to cause their discontinuance.

Every radiumtherapist should know how to make use of the radium rays which are most suited to the cellular modifications of the tissues in question.

As a matter of fact, it has been found that morbid growths of the skin disappear rapidly under extensive surface raying which has been shown to be the best treatment for vulvar vegetations.

In these conditions we use applicators 4 cm. square containing 10-mgm. of radium bromide, and they are left in position for three-fourths hour to one hour according to the depth of the growths. The applicator is covered with a thin sheet of "English leaf," for the purpose of protection.

In the case of vegetations with a large base, or if a caustic treatment has been used which has produced slight cicatricial tissue, we prefer to make use of a thin filter; thanks to this, without fear of a reaction, we can prolong the application and allow the rays to act for a longer period on the deeper areas of the skin.

The same applicators as the above are used with a screen of 0.1 mm. of lead (English leaf). The time of application varies from three to five hours, according to the depth of the growth.

The areas of healthy skin between the growths are protected with lead 0.5 mm. thickness, while the growths can be covered with the apparatus described above.

VAGINAL GROWTHS.

As it is difficult to use glazed applicators in this location, we use, though somewhat reluctantly, radium tubes containing 25-milligrams of radium bromide.

We prefer tubes which have a casing of 0.3 mm. of platinum surrounded by a covering of gauze; we give an 8 hours' application in one or two treatments.

Following these treatments, disintegration of the vegetation is effected without any reaction and three or four weeks after the conclusion of the applications the genital region has resumed a normal appearance, and the disturbances incident to the growths have disappeared with them.

We are therefore, in possession of a method which is able to bring about the disappearance of a condition which is apt, in its consequences, to cause trouble in the course of pregnancy and delivery, without bringing with it any danger in any way to the nervous equilibrium which is in a precarious condition in the pregnant women.

For these reasons it seems to us that Curietherapy of malignant growths of the vulva should be more widely used; the object of this paper is to strongly advocate such treatment.

General Considerations in the Application of Radium

(Second Edition)

WILLIAM H. CAMERON, M. D.

Pittsburgh.

NOVEMBER, 1921

PERSONAL SAFETY FOR THE OPERATOR.

LOCAL EFFECT:

The important thing for radium workers to consider is the repeated short dose effect of radium rays and the changes that will occur in normal tissue when this effect is disregarded. A technic for the radium worker must, then, include a plan designed to prevent repeated digital contact. If such a plan (see writer's suggestions in article on the "Technic of Preparing Radium Tubes and Needles for Therapeutic Use") is not rigidly followed, loss of tactile sense, distorted finger nails, more or less fibrosis of finger ends and radium keratosis will result.

Ordinary screening (radium screened to cut out all primary and secondary beta rays) does not offer a great amount of protection for the one who must handle radium frequently. One of the most obstinate burns I have ever seen was produced by carrying, a short time daily for a period of about six months, a heavily screened fifty milligram tube.

It is true that gamma rays may be absorbed sufficiently to practically eliminate this danger. To accomplish this, however, the necessary metallic material (two inch thickness of lead, will absorb almost 94% of the gamma rays) would be cumbersome; therefore, any protective technic should be based on the other alternative, "distance effect."

GENERAL EFFECT:

It is established beyond question of doubt that a systemic effect is produced by repeated absorption of gamma radiation. I believe certain individuals are especially susceptible, but there is no way to determine this point in advance, nor, do we know just how little or how much exposure will produce systemic changes. In a series of blood examinations made on men exposed daily to large amounts of radium, no abnormalities have been noted. Some of these men have been exposed for a period of five or six years, but every man examined has taken extraordinary measures of protection. Cases are reported (see "Radium," July-August issue, 1921), however, where grave changes have taken place; therefore, the radium worker must make "General" as well as "Local Protection" a constant part of his technic. In screening or otherwise handling radium, a protective stand should be used (lead plates two inches thick), and when this is not possible, the radium should be held away from the body. When the radium is not being used it should be stored at some distance from the worker—the greater this distance the better.

SAFETY OF THE RADIUM

During the past three or four years some thirty tubes and needles have been lost or broken. While most of the radium has been recovered, it indicates that care in handling is not given proper consideration. When radium is lost it indirectly affects all radium owners; for how long will insurance premiums[1] remain at a reasonable figure if such losses continue?

Aside from this factor there is considerable expense and loss of time in tracing, extracting and re-tubing the material.

(1) Since this article has been written the rate has increased from two to three per cent.

Mechanical strength should be the first consideration in a radium capsule (metal tube containing glass tube) or needle, but present therapeutic utility demands compactness to the point of frailness, consequently the operator must exercise greater care in handling tubes and introducing needles. Surgeons working with ordinary inexpensive instruments should be especially mindful of their radium equipment, keeping tube forceps, special radium needle holders, etc., etc., in a separate instrument tray,—this to lessen the dangers of grasping radium capsules or needles with other than the instruments made for that special purpose. Furthermore, radium needles should not be plunged into dense tissue without first making a track with some sharp cutting instrument.

The majority of patients and lay attendants do not graps the fact that radium applicators are something above the ordinary, and they should not be trusted to look after the safety of the radium. All capsules, stock screens and needles are constructed so that they may be securely fastened to the patient and, of course, should be fastened independently of the dressings. If the operator neglects this part of his technic, the patient cannot be blamed if a tube slips away from its moorings and becomes lost. To impress patients, lay attendants, nurses and resident physicians with the significance of radium applications, it is suggested that all external dressings be labelled with a sticker upon which the word "Caution" is printed. For cavity work, the adhesive plaster used to fasten the external safety string may be marked (red ink) with the same caption.

In clinical or hospital work, the radium is frequently removed by an assistant or nurse. The party removing the radium should be present at the time the applicator is placed and upon removing, should be required to place all screens, dressings, adhesive plaster, etc., etc., in a specific place until the owner checks up the capsules or needles used in the application. So many capsules have been thrown away with soiled dressings, that a special container for soiled dressings from radium patients should be provided. This container should have a distinctive mark or a spring lock, and contents should not be removed until all capsules or needles have been checked by the operator.

CARE OF CAPSULES. TUBES AND NEEDLES

I have been astonished to see how many otherwise careful workers neglect the cleansing of their capsules, needles, plaques and screens. Dirt not only means danger of infection, but it will cause deterioration in the thin metal wall. Radium equipment, I believe, should include three small wide mouth bottles, one to contain benzine or ether, one alcohol (or other non-corrosive germicide) and one containing sterile lubricating oil.

After capsules (glass tubes should not, as a rule, be removed from silver capsule) or needles are removed from a patient, they should be dipped in the benzine to remove dried secretions, etc., and then in the alcohol. Dry by rolling (with forceps) on sterile gauze. A dip in the sterile oil will keep metal parts in good condition and prevent sticking in screens or containers.

Before using on patient, the same procedure is followed with the exception of the oil immersion. When needles are to be introduced they may be dipped for a short time in boiling water. Metallic screens should be boiled before using and, after using, boil and immerse in sterile oil before putting away. Rubber screens should also be boiled before and after using.

DISADVANTAGES OF RADIUM NEEDLES.

Because of the increasing popularity of metallic needles containing radium *element*, it may be well to point out some of their disadvantages.

Results of the work at the Memorial Hospital, New York, with the use of buried *emanation* tubes, lead to the suggestion that needles containing small amounts of radium *element* might also be employed. The *emanation* tubes contain from 0.5 to 2.0 millicuries of *emanation* each, and the use of one such tube per cubic centimeter of tissue usually gives a destructive dose of rays. Each millicurie of emanation on complete decay emits a total of 132 millicurie hours of radiation and this dosage corresponds to from 66 to 264 millicurie hours per centimeter of tumor tissue. The bulk of 1 millicurie of *emanation* is 0.0006 cubic millimeters, whereas the bulk of 1 milligram of radium *element* in the form of nearly pure dense sulfate is approximately 0.5 cubic millimeters. The emanation, by reason of its transient value, can be placed in a hair-like glass tube 0.3 mm. in diameter and 3 mm. in length. Radium salts, on account of their great value, must be placed in suitably strong capsules, so that the dimensions of a 10 to 12.5 milligram needle are 28 mm. in length and 1.75 mm. in diameter—the radium occupying a space 10 to 12 mm. in length at the rear of the point.

The metallic needle containing radium salts does not emit the same proportion of beta rays that come from the small glass emanation tube. There can be no question that the beta rays from the emanation tube play an important part in the result obtained. Neglecting this difference in action, if the same dosage is to be employed when the metal needles are used, the extensive trauma produced by inserting a large number of these needles is not warranted by the gain made through greater distribution. This fact has resulted in the general employment of needles containing 10 to 12.5 milligrams of radium element rather than the smaller amounts. For example: If a number of such needles are used 1 centimeter apart in the tumor mass, the average dose of 132 millicurie hours per centimeter of tissue can be obtained by having a 10 milligram needle in place for 13 hours, or a 12.5 milligram needle in place for about 10 hours.

The removal of the needles after such a length of time is a matter of no great difficulty, whereas, it becomes increasingly difficult as the time of application increases, owing to repair of tissue along the track of insertion. The use of a 5-milligram needle would involve exposure of 25 hours or longer to give the same dosage,, and it is largely for this reason that the use of such needles becomes disadvantageous.

Needles containing small quantities of radium element have the further disadvantage in cavity work of making bulky applicators when grouped to make the dose equivalent to that of the glass capsules.

An erroneous idea that is frequently encountered is that by grouping needles on a flat surface, there is obtained the equivalent of a glazed surface plaque. This is not true, because the wall thickness of the needle (0.4 mm.) absorbs over 87% of the hard beta rays —the rays that are so frequently and so advantageously employed in surface work. Furthermore, the radium salt fills only a part of the length of the needle (10 to 12 mm. back of the point) and this fact must be considered not only in grouping the needles, but in placing them in such localities as the inner canthus of the eye.

SCREENING.

GENERAL:

The fundamental principles of screening should not be sacrificed for convenience in placing radium. Ordinary screening (screening to cut out primary and secondary beta rays) should not, under ordinary circumstances, be omitted in long cavity applications. Secondary beta ray screening should not be omitted under any circumstances, the exception being, of course, where using buried needles. When a concentrated action is to be avoided, "distance screening" should be employed. That a distance of from 2 to 5 mm. will materially lessen this concentrated effect, is amply demonstrated in uterine work.

SCREENING RADIUM CAPSULES:

Capsules containing 25 to 100 milligrams of radium are, as a rule, placed in a silver capsule of 0.5 mm. wall thickness, thus absorbing 97% of the hard primary beta rays. To absorb the remaining beta rays, 1.0 mm. of brass is used, brass being selected because of its mechanical fitness. To absorb the secondary beta rays, cover the brass screen with some thin non-conducting material, such as rubber or paper. When distance is desired, secure the distance by interposing a non-conducting, material such as rubber, wood, felt, gauze, paper, etc.

SCREENING RADIUM NEEDLES:

The wall thickness of standard needles is 0.4 mm.—cutting out 87% of the hard beta rays. When needles ore introduced into tissue, no attempt is made at further screening. When used otherwise, they must be screened as above described, 1 mm. of brass being sufficient for the complete absorption of the primary beta rays.

GENERAL POINTS INFLUENCING TECHNIC.

AGE OF PATIENT:

Young patients with malignancy require more intensive radiation than is the case with an identical condition in patients past middle life.

TEMPERATURE:

Patients with temperature indicating an acute infection should not be rayed, at least until it has been ascertained that the infection is not located in the vicinity where the radium is to be applied. Temperature elevation during a cavity application is an indication for removal until the exact cause of temperature is determined.

PAIN AND TENDERNESS:

Acute pain or tenderness in the fallopian tube or ovaries requires careful investigation before radiation. This rule applies to all cases not associated with malignancy.

BLOOD PICTURE:

Patients with a low white cell count or presenting symptoms of anaemia should receive divided dosage, with at least twenty-four hour intervals.

AREA OF LESION TO BE RAYED:

The radiation includes not only the ulcerated surface but all the indurated area, and, in most cases, the area of draining lymphatics.

CHARACTER OF SURROUNDING TISSUE:

Lesions located in tissue containing numerous blood vessels and lymphatics should, as a rule, receive radiation only. If surgery is to be had or many needles to be introduced, it may be well to give a surface radiation first.

CHARACTER OF LESION:

Generally speaking, rapidly growing lesions, having young blood vessels, etc., are radiation cases only. In slowly growing tumors, radium is frequently combined with surgery.

PREVIOUS TREATMENT:

Previous treatment has altered tissue, and such cases may requre a greater or less amount of radiation than one would ordinarily give.

RECTAL AND BLADDER IRRITATION:

In long applications to the cervix, the bladder and rectum must be empty. The vagina should be carefully packed with gauze, not only to hold the radium tubes in place, but to increase the distance between the radium tubes and the walls of the vagina.

AVOID PROLONGED RADIATION OF NON-MALIGNANT CASES IN THE CHILD-BEARING PERIOD:

Radiation within the uterine canal with amounts over 25 milligrams for longer periods than six hours may produce a suppression of menstruation.

NAUSEA:

Some patients experience nausea while radium is in the uterus. The effect may be mechanical, due to the presence of a foreign body, in which case relief will not be had until the radium tube is removed; or, it may be a general radioactive sickness. At the present time the nature and treatment of this condition is not well understood.

APPLICATORS:

Many so-called universal applicators are in use, but their employment tends to lessen the study of individual case requirements. In cavity work an applicator that produces an unnecessary amount of irritation while in place, causes damage by increasing the radium reaction.

CONTRA-INDICATIONS:

Pedunculated fibroids, fibroids causing acute pressure symptoms, and any acute inflammatory process, particularly in the tubes and ovaries.

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GENERAL SUGGESTIONS IN APPLYING RADIUM

PREPARE THE PATIENT AS CAREFULLY AS FOR OPERATION:

Tissue subjected to radiation has less resistance to ordinary infection; therefore the parts to be rayed should be properly prepared.

STERILIZE YOUR CAPSULES NEEDLES, SCREENS, ETC.

Radium tubes are frequently placed for long periods of time in or on tissue of lowered resistance; therefore, they should be surgically clean when applied.

DO NOT BOIL OR USE DRY HEAT TO STERILIZE SILVER CAPSULES CONTAINING RADIUM IN GLASS TUBES:

Use carbolic acid, alcohol, ether, etc. The metal and rubber screens should be boiled. Needles may be dipped in boiling water. Since the needles are soldered, intense heat must be avoided.

DO NOT SACRIFICE SCREENING FOR EASE IN APPLICATION UNLESS IN A DESPERATE CASE:

The action of the beta rays on the endometrium, for instanc, may be so severe as to cause a uterine discharge for some time after radiation.

PREVENT ADHESION AND CONTRACTION OF VAGINA AFTER RADIATION:

In extensive radiation of the cervix and vagina, adhesions and contractions may result. To lessen, give patient a daily, mild, antiseptic douche during the reaction period and for some time after reaction has subsided.

DO NOT FAIL TO FASTEN TUBES SECURELY:

Frequently tubes and needles are lost because they drop from under the dressing, or are taken away from the dressing. Fasten your tubes with a heavy silk ligature and secure them independently of the dressings.

TO AVOID A BURN:

In prolonged raying through skin surface and over scar tissue, use from one-fourth to one inch distance, securing the distance by interposing a non-metallic substance.

Frequently it is impossible to avoid burning the tissue. This is especially true of the mucous membrane of the mouth. It is advisable to give the patient a mild antiseptic mouth wash to be used at frequent intervals. If on the skin surface, a simple ointment may be employed. Frequently, however, the pain cannot be relieved with any external application until the reaction is over. In severe burns on the skin, fulgurate to secure healthy granulations, and follow with skin graft.

GENERAL CARE OF THE CANCER PATIENT:

Remember that the cancer patient is ill, desperately ill, and should be given the benefit of anything such as rest, diet, fresh air, etc., that will build up resistance. Proper care of the local lesion is essential.

RADIUM APPLICATIONS IN MALIGNANCY.

SKIN LESIONS:

Radium is the agent of choice in skin cancer. When the periosteum is involved, the prognosis is not so good. When bone is involved, destruction of the involved area by surgical measure is to be considered in conjunction with radiation. Melano-epithelioma yields only palliative results. Several cases have been reported recently in which intensive radiation has apparently given results in this condition.

LIP:

Radiation to the local lesion and over draining lymphatic with x-ray over the entire chest. Reports seem to justify the claim that radium is superior to surgery in early cases.

LINGUAL AND BUCCAL MEMBRANES:

Buried needles are used when possible, and one treatment to local lesion given. When surface applications are necessary, dental impression compound is being used to hold tubes in place. Draining lymphatics are always rayed with radium, and x-ray applied to the entire chest. In recurrent cases with large glands, the glands are sometimes rayed and then removed.

ANTRUM:

Remove as much of the involved tissue as possible with heat (soldering iron) and then ray. This technic seems to be giving the best results.

OESOPHAGUS:

Radium is the best palliative agent. These cases must be carefully studied before application in order to place radium accurately.

STOMACH AND INTESTINAL TRACT:

No satisfactory method of applying radium has been advanced.

RECTUM:

Palliation is aim in this case. Colostomy will assist in placing the radium and, by removing feces, lessen irritation to the parts being rayed. In advanced cases, patient should be told of the discomforts of colostomy.

BREAST:

Early cancer of the breast is considered surgical, followed by radiation. Radium has made seemingly inoperable cases operable. Only in terminal cases is radium alone employed, and then for its palliative effect. The best time for prophylactic radiation is a question that must be decided for the individual case.

FALLOPIAN TUBES AND OVARIES:

Not satisfactory.

Removed by surgery if early, and radium tubes or needles buried at time of operation. If inoperable, may be treated by the use of radium needles via perineum, rectum or suprapubic, or the cross-fire method via rectum and urethra.

BLADDER:

Each case should be carefully studied as to the best method of approach. Suprapubic operation offers the best method of placing radium and should be done when possible.

FUNDUS:

Early cancer of the fundus is surgical after radiation if the patient is in condition to stand a radical operation; otherwise it is a case for radium only; and no case, however severe, should be denied the palliative benefit of radium. In terminal cases, great care must be taken in radiation.

CERVIX:

Cancer of the cervix is in all stages a radium case.

SARCOMA:

In posterior nasal space and tonsil, radium is the agent of choice; other localities, surgery and radium.

OSTEOSARCOMA:

Combination of surgery, x-ray and radium.

LYMPHOSARCOMA:

Radium is the agent of choice. Give surface radiation before introducing needles.

PRE-CANCEROUS CONDITIONS

LEUKOPLAKIA:

Radium is the best agent.

PIGMENTED MOLES:

Radium is used when lesion shows signs of degeneration.

NON-MALIGNANT CONDITIONS

COSMETIC RADIATION:

The greatest care must be taken in conditions being removed for cosmetic purposes. Give so-called port wine stains the utmost care and attention. To secure a perfect result in such cases is the most difficult task of radium work.

FIBROIDS:

In uterine fibroids (in forty per cent. of the cases), radium is the

ent of choice, but strict regard must be given to certain contra-dications, such as pedunculated, large and very soft fibroids.

EUKORRHEA:

In sub-acute and chronic leukorrhea, according to recent reports, radium has proved to be efficient when other methods have failed.

PAPILLOMA:

In bladder, combined radium and fulguration. In larynx, radium only.

EXOPHTHALMIC GOITER:

The tendency seems to be in favor of radium as the agent of choice.

LEUKAEMIA:

Offers a large palliative field, and radium seems to control the condition longer than any other single method now employed. Raying the spleen and transfusion is, I believe, the method of choice in many of these conditions.

THYMUS GLAND:

Enlarged thymus glands in children, according to a recent report by Heublein, is a field in which radium comes to the front as the agent par excellence.

CATARACT:

Reports seem to be favorable in certain types. Raying should be attempted only by those thoroughly familiar with this condition.

TUBERCULAR ADENITIS:

Radium agent of choice. Pus should be drained by small incision before radiation.

INFECTED TONSILS:

Radium is suggested in this condition when operation is not indicated. Chronic cases only treated.

SOFT NASAL POLYPI:

Radium suggested after removal.

SUB-ACUTE AND CHRONIC INFLAMMATORY SKIN LESIONS:

Small doses of radium used in a number of these conditions.

General Considerations in the Application of Radium

WILLIAM H. CAMERON, M. D.

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PITTSBURGH, PA.

GENERAL CONSIDERATIONS IN THE APPLICATION OF RADIUM

William H. Cameron, M.D.
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The first use of radium as a therapeutic agent was, like i discovery, more or less accidental. During this early peric advance was handicapped by lack of supply and by indifferei preparation and standardization of the material used.

Later Kroenig and Gauss used rather large amounts of tl radioactive material—mesothorium, and as a result of the experience gave out very favorable reports as to the action of tl rays in uterine and cervical cancer. Following these repor scientific interest was gradually stimulated.

(In considering the early work with radium, mostly carri on in France and Germany, we must not forget that it was o own Doctor Abbe of New York City who was the first physici to apply radium in cancer of the cervix, and one of the first apply radium for uterine fibromata).

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Today cancer, inoperable cancer and radium are almo synonymous terms, although cancer is as I will point out late only one of the many pathological conditions for which radiu is now employed.

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With increasing interest on the part of the medical profession, American business ingenuity and foresight, anticipating the demand, was ready with amounts sufficient for extensive clinical purposes; moreover the art of production had so far advanced that definite amounts, properly measured and standardized, could be employed.

Today cancer, inoperable cancer, and radium are almost synonymous terms, although cancer is, as I will point out later, only one of the many pathological conditions for which radium is now employed.

By the radiologist, cancer must be considered from many angles. First, he considers the anatomical location of the lesion. He must decide the amount of the susceptibility of the surrounding normal tissue to the action of his rays. The greater or less amount of blood supply to his lesion and the draining capacity of the lymphatic system must also be considered.

Next, of course, he must consider the minute and gross structure of his lesion and the blastodermic origin of the tissue from which it springs. It has been found that the minute as well as the gross structure of the various types of cancer responds differently to his ray and, frequently, knowing the blastodermic origin of the tissue from which the lesion springs is the only key he has to the cell structure.

Again he must take into account the patient's general condition. He must know how the patient is fighting his cancer invasion. Is there a natural or artificial immunity against the invasion, and if so, can he increase this immunity, or is he liable by under or over raying to break it down? In addition to this, he may assume that, in so far as the buccal and lingual cases are concerned, he has, in at least 15 per cent of his cases, a double invasion to deal with—cancer and syphilis, and his technics must be altered accordingly.

Dealing for the most part with border-line, advanced and terminal cases—cases that, as a rule, have had previous treatment—he must consider the fact that the pathological tissue may have been somewhat altered and the surrounding healthy tissues weakened by such treatment. Caustics, indifferent surgery, arsenical pastes, excessive x-ray and other agents alter the tissue with which he has to deal. Failure to recognize this fact may result in failure.

In other words, the radiologist must consider each and every individual cancer involvement in its relations to the patient; in fact he will do well to consider each and every patient as having a separate and distinct disease. For instance, cancer of the lip will mean more to him if he knows whether it springs from the skin margin or from the mucous membrane. Cancer of the buccal surface of the cheek will not be considered the same as cancer of the antrum, although the pathologist may report the same cell structure. Cancer of the fundus is not, because of its location, the same disease as cancer of the cervix. Careful weighing of all the facts determines his method of attack, and upon his method of attack depends his success or failure. This applies when a curative result is the end in view, or when palliative effect only is intended, and by method of attack I mean radium alone; surgery and radium; or, surgery, x-ray and radium, or fulguration and radium.

The use of radium and x-ray has added greatly to our knowledge of the clinical progress of cancer, and success in cases wherein other methods have failed permits, in a number of conditions, radium to pass from the palliative agent to the more hopeful outlook of being able to cure the disease when it is a local disease—that is in its early infancy.

The surgeon constantly cries, "Send your cases early; it is the only time when we can cure cancer." A cure is obtained in many cases, but it is a cure accompanied by mutilation. The radiologist is beginning to put forth the same cry and if, in the same percentage of cases, a result is obtained without mutilation, why not?

In border-line and advanced cases, extensive surgery, with its excessive bleeding; its failure to close blood channels; its failure to influence draining lymphatics; the necessary violent manipulation of the cancer tissue in situ; the necessary ingestion of a large amount of chloroform and ether, all tend to break down the one thing this class of cases needs—fighting strength. There is also a high primary mortality and usually a rapid return of all the disagreeable and painful symptoms, with a typical cancer death. With radium there is no hemorrhage, no manipulation, at the most a very short anesthesia, the blood vessels are occluded rather than left wide open, and the draining lymphatics are sealed. The distant diseased cells, if not destroyed, are weakened. The patient's natural immunity is in no way disturbed, provided radiation is controlled, and if there is death, it is deferred and void of the harrowing features.

Surgery removes the local lesion to the limit of cutting possibility, but at what a price to the patient! Radium removes the local lesion and sickens the cells far beyond what may be accomplished by the most careful dissection. The patient does not suffer surgical shock nor lose fighting ability. If a member of your family has been so unfortunate as to reach the border-line stage of cancer, what choice can you have?

* * * *

RADIUM APPLICATIONS IN MALIGNANCY

At the present time radium is considered the agent of choice in skin cancer. Melano epithelioma, however, being hard to control, yields only palliative results.

Cancer of the lip, when springing from the skin surface, is a radium case. Springing from the mucous membrane (and very early) it is treated with surgery and radium, with x-ray over the glands of the neck and chest. In advanced cases, radium and x-ray are used over the lesion and glands, including the glands of the chest.

Cancer of the lingual and buccal mucous membrane is treated with radium and fulguration. No sharp cutting instruments should be used in this location. Salvarsan may be administered as a routine agent in these cases, giving the salvarsan at the height of the radium reaction.

Treatment of cancer of the antrum should be fulguration, or the soldering iron used, plus radium. Metastasis does not occur so early in these cases, but the glands should be rayed as a routine measure.

Cancer of the oesophagus is a radium case—with perhaps, surgery by an ultra-skillful surgeon—if in the very early stage. Radium is the best palliative agent in advanced cases, but must be used with care, because of the effect of the rays on the cartilagenous tissue.

Cancer of the stomach and intestinal tract is treated surgically, followed, if possible, by radiation. The mechanical difficulties in placing radium in the stomach have not been overcome.

Early cancer of the breast is considered surgical, and radium has made seemingly inoperable cases operable. Only in terminal cases is radium alone employed, and then for its palliative effect. The surgeon who operates for cancer of the breast without afterwards subjecting his patient to prophylactic radiation, is not a surgeon but an operator. The best time for prophylactic raying is a question that must be decided for the individual case.

Cancer of the gall bladder, tubes and ovaries should have radium tubes buried in the mass during the time of the exploratory operation. This procedure may be only palliative in effect, but it is the best we can do.

Cancer of the rectum is a condition not treated satisfactorily from any standpoint. If it is inoperable, it should be rayed only. In either case, colotomy should be had to prevent constant irritation to the parts after radiation and to reach the mass from above.

Cancer of the prostate may be removed (if early), and radium tubes and needles buried at the time of operation. If inoperable, it may be treated by the use of radium needles via perineum, or the cross-fire method via rectum and urethra.

Cancer of the bladder. Radium offers the best hope, and a suprapubic is done in order to facilitate the placing of the radium and to provide for good drainage.

Early cancer of the fundus is a surgical condition if the patient is in condition to stand a radical operation; otherwise it is a case for radium, and no case, however severe, should be denied the palliative benefit of radium.

Cancer of the cervix is in all stages a radium case. I say this, knowing full well the opposition that will be created. When surgery, however, can show end results now being procured with radium, then, and then only, will I retract this statement.

Generally speaking, in osteosarcoma radium should be combined with surgery when possible. In lymphosarcoma radium acts like magic, but in melano sarcoma radium at best is only a palliative.

* * * *

RADIUM APPLICATIONS IN NON-MALIGNANT CASES

I am not going to discuss cosmetic conditions, other than to sound a note of warning in the treatment of the so-called port-wine stains. The greatest care must be taken in these conditions, otherwise the patient will present a result fully as disfiguring as the original mark. Careful consideration must also be given to the removal of precancerous lesions.

In angiomas of all sizes, radium is doing work that is simply remarkable, entirely removing this condition from the surgical field.

In uterine fibroids, in forty per cent of the cases radium is the agent of choice, but strict regard must be given to certain contraindications.

In uterine hemorrhage, radium is almost a specific, but here again, due regard must be given to the prevention of certain annoying immediate after effects.

In sub-acute and chronic leukorrhea, according to recent reports, radium has proved to be efficient when other methods have failed.

In papilloma of the bladder, radium is used after fulguration.

In cases of inoperable hypertrophic goiter, radium is being employed more and more; in exophthalmic goiter, the tendency seems to be in favor of radium as the agent of choice.

The leukaemias offer a large palliative field, and radium seems to control the condition longer than other single methods now employed. Raying the spleen, with transfusion, is, I believe, the method of choice in many of these conditions.

Enlarged thymus glands in children, according to a recent article by Heublein, is a field in which radium comes to the front as the agent par excellence.

Recent reports seem to indicate that radium will occupy as prominent a place in the treatment of cataract as it now does in the treatment of spring catarrh.

A surgeon seeing the results produced with radium in tubercular adenitis will, I am sure, not again risk the unsightly scars frequently resulting from surgical treatment of this condition.

GENERAL RULES TO BE OBSERVED IN RADIUM APPLICATIONS

(1) *Prepare the Patient as Carefully as for Operation.*—Tissue subjected to radiation becomes somewhat altered and has less resistance to bactericidal invasion.

(2) *Sterilize your Tubes, Screens, etc.*—Radium tubes are frequently placed for long periods in or on tissue of lowered resistance, therefore they should be surgically clean.

(3) *Do Not Boil or Use Dry Heat to Sterilize Silver Tubes Containing Radium or Radium Needles.*—Use carbolic acid and alcohol. The metal and rubber screens should be boiled.

(4) *Avoid Rectal and Bladder Irritation.*—In long applications to the cervix and vagina, it is advisable to introduce a retention catheter to prevent bladder distension, and the rectum should be empty. The vagina should be carefully packed with gauze, not only to hold the radium tubes in place, but to increase the distance between the radium tubes and the walls of the vagina. By doing this, bladder and rectal irritation is reduced to almost nil.

(5) *Avoid Prolonged Radiation of Non-Malignant Cases in the Child-Bearing Period.*—Radiation within the uterine canal with amounts over 25 milligrams for longer periods than six hours may produce a suppression of menstruation.

(6) *Do Not Sacrifice Screening for Ease in Application unless for a Desperate Case.*—The action of the beta rays on the endometrium, for instance, may be so severe as to cause a uterine discharge for some time after radiation.

(7) *Prevent Adhesion and Contraction of Vagina after Radiation.*—In extensive radiation of the cervix, adhesions with some contractions may result. To avoid, give patient a daily mild antiseptic douche during the reaction period and for some time after reactions have subsided.

(8) *Watch the Blood Count and Temperature when Raying in Severe Cases of Cancer.*—Patients with a very low white cell count will do better with smaller doses more frequently repeated than with a few prolonged treatments.

(9) *To Avoid Nausea.*—Some patients experience nausea while radium is in the uterus. Sodium Bicarbonate or other alkaline agent will sometimes relieve this condition and should be given before, during and after radiation. The effect may be mechanical, due to the presence of a foreign body, in which case relief will not be had until the radium tube is removed.

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(10) *Do Not Fail to Fasten Tubes Securely.*—Frequently tubes are lost because they are taken away with the dressings. Fasten your tubes with a heavy silk ligature and secure them independently of the dressings.

(11) *To Avoid a Burn.*—In prolonged raying through skin surface and over scar tissue, use from ¼ to 1 inch distance, securing the distance by interposing a non-metallic substance.

(12) *Treatment of Radium Burns.*—Frequently it is impossible to avoid burning the tissue. This is especially true of the mucous membrane of the mouth. It is advisable to give the patient a mild antiseptic mouth wash to be used at frequent intervals. If on the skin surface, a simple ointment may be used. Frequently however, the pain cannot be relieved with any external application until the reaction is over.

(13) *General Care of the Cancer Patient.*—Remember that the cancer patient is ill, sometimes desperately ill, and should be given the benefit of anything that will build up resistance. Rest, diet, fresh air and proper care of the local lesion are essential. It is astonishing to see the carelessness regarding the care of the local lesion, and frequently the patient has to fight a mixed infection because of this carelessness. It may not be well or practical to apply a surgical dressing (the less mechanical interference with the wound the better) but it is possible in most cases to keep the wound clean.

(14) *Warn a Patient Regarding Radium Reaction.*—During the reaction period, the wound may appear to be highly stimulated and frighten the patient, and they will sometimes not return for necessary future treatment. Always explain this to the patient, so that they may know what to expect.

(15) *Contra-Indications.*—Pedunculated fibroids; fibroids causing acute pressure symptoms, and any acute inflammatory process, particularly in the tubes and ovaries.

Quick, Douglas, M. B. (New York): The Response of Various ypes of Cancer to Radium. ***The Canadian Practitioner,*** **January, 923, 1-9.**

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General Considerations

NOTES.

During the past two or three years radium has come to occupy a much stronger position in the treatment of malignant diseases. The mass of experience being accumulated, both clinically and experimentally gives a definite basis upon which to continue the work.

The purpose of this paper is to give some idea of the present value of radium as a therapeutic agent. In the first place, it must be understood that radium is not a "cure-all." Neither does it fulfill the first principle of being a cancer cure—that of being a constitutional agent. It is, however, the greatest single agent at our disposal in combatting malignant disease.

It is a fallacy to think that radium is an agent to be used where all others have failed.

While radium reactions are not always painful, there are certain types of cases in which complete regression of disease cannot be obtained without going through a distinctly painful period. This is an added reason for withholding it from the hopelessly advanced case.

In general, the rapidly growing cellular tumors respond more readily to radiation, but the end results are equally unstable, because of the danger of early and wide-spread metastases.

Neoplasms which tend to remain localized and metastasize late in the course of the disease are most favorable. Those which metastasize locally only are more suitable than those which extend widely and early in the course of the disease. Tumors which extend through the lymphatics, as a rule, are more amenable to treatment than those spreading through the blood stream.

Certain types of tissue withstand radiation more than others. Nerve tissue and dense fibrous tissue are more resistant than epithelial tissue. Endothelial tissue is very promptly affected by radium.

TECHNIQUE.

Speaking in general, there are two ways of applying radium—filtered radium placed on the surface, or at a distance from it, and unfiltered emanation buried in the tumor tissue. Apart from the question of dosage, the most important factor at present is accuracy and, to a certain extent, intimacy of application. We have long since passed the time when a piece of radium could be placed in the neighborhood of a new growth in a haphazard manner, and a favorable result expected. This explains many of the results that we hear quoted daily.

For many lesions the use of filtered radium over the surface is quite sufficient to produce a complete regression of the disease. It is, however, an extravagant method in one sense, because only a small fraction of the radiant energy is being directed toward the disease; the remainder is being wasted on surrounding healthy tissues—at times damaging them—or is going off into space. Placed over the surface the greatest intensity of the dose is being delivered to the least vital part of the growth—its surface rather than the actively

growing infiltrating base. If the neoplasms be deep seated, and the radium placed several centimeters from the surface, the healthy overlying tissues must absorb more radiation than the tumor itself. So far, we are forced to treat many growths in this manner. The fact remains that it results in a waste of energy, and, since radium is scarce, we must attempt to obviate this loss as far as possible.

Since it has been possible to collect the active principle—radium emanation—from the element itself, this problem of conservation of energy and uniformity of application has been solved to a considerable extent. Radium emanation decreases in value at the rate of about 15% per day. It can be collected in very fine thin-walled glass capillary tubes 0.5 x 3 mm. in size. These tubes can be measured in terms of radium element and they can be sterilized by boiling. With a fine trocar needle they can be embedded in tissues and left *in situ.* Since we know their rate of decay, it is a simple matter to calculate the total dosage to be derived from a given amount buried in the tumor. I believe it is safe to say that this method of radium application has completely revolutionized our work.

Radiation can be distributed uniformly throughout a neoplasm and placed where it is needed most. All of the radiation is utilized—both beta and gamma rays. Normal tissues are saved a great deal of useless radiation. In addition to the direct effect on tumor tissue, a very marked lymphocytic infiltration is excited, which, as far as we know, is the greatest single defense of the body against malignant invasion. We have had no untoward effects from the small tubes as foreign bodies—the inflammatory reaction excited about them promptly aids in walling them off in a small fibrous tissue capsule. Care must be taken not to introduce them through sloughing infected areas unless drainage is free, otherwise mixed infection will be carried deeper. It is best where possible, to introduce them through the healthy surrounding tissues. Trauma is slight indeed, and when reasonable precautions are taken the dangers of this method are practically negligible.

In certain cases, where surgical removal of the tumor has been carried out, emanation may be buried at any suspicious points within the wound while it is still exposed.

Of the various groups in which radium has proven of great value, mention should be made of intra-oral carcinoma. In all of these lesions of the lip, tongue, floor of the mouth, mucosa of the cheek and pharynx, radium alone is the agent of choice. In carcinoma of the larnyx also we are inclined to use radium alone in the majority of cases.

Carcinoma of the oesophagus is an extremely hopeless disease from every angle. In such a thin-walled organ the disease has practically always extended beyond it before symptoms are noted. The most we have accomplished is to give palliative relief by slowing up the growth and keeping the structure open to a certain extent.

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In carcinoma of the uterus, and especially of the cervix uteri, radium undoubtedly has one of its best fields. The organ stands large doses of radiation extremely well, and the results are excellent—if we may use such a term in speaking of malignant diseases. In the best hands, carcinoma of the cervix has passed out of the operative field. I make this statement very advisedly.

With neoplasms of the bladder and prostate encouraging results have been obtained, althought I am inclined to feel that in the former surgical exposure may very often facilitate treatment. Many prostate cases, even though advanced, are palliated for a considerable period.

The breast is another group in which radiation has proven of inestimable value. In inoperable and recurrent cases it has been a blessing indeed, while in the operable group it is a valuable adjunct to surgery. I believe I am safe in saying that the operable group is being steadily reduced.

One type of case that has been very resistant to all forms of radiation is the neurogenic sarcoma—a growth arising in the nerve sheath and frequently termed a fibro-sarcoma. Surgical experience has been bad, and radium has been no better.

With the bone tumors results have been variable. Giant-cell sarcoma of course gives good results. The true osteogenic sarcomas, on the other hand, have not been as favorable. Some regression occurs in a large percentage, but dissemination through the blood stream is rapid and early, and as yet no means of successfully dealing with these metastases has been found.

In the lymphatic glandular diseases—lymphosarcoma, Hodgkin's disease, and leukemias—radium experts perhaps its most spectacular effects. Regressions are very rapid but, unfortunately, are not permanent. Palliative relief may sometimes be given over a period of years, but the end results are probably all the same. More recent work with an active deposit of radium has given results of great promise, but as yet it is too early to offer definite conclusions.

Teratoid carcinoma of the testicle is another growth which gives spectacular results, but dissemination is so widespread that in the majority of cases it is doubtful if many permanent results are obtained.

Brain tumors have shown a variable response—some extremely interesting and gratifying results have been obtained but the period of observation is still brief. Our experimental work indicates that normal brain tissue withstands radiation very well—a factor of importance in dealing with new growths in this location.

It is impossible to index all of the various types of malignant disease and their response to radium. One group that should be mentioned in closing, however, is that of parotid tumors. Most of

them are mixed tumors and a few epidermoid carcinomas. The results have been most uniformly successful. Epithelioma of the skin responds favorably in nearly 100 per cent. of cases unless extremely advanced.

The fact that radium does not cure all cases in which it is used is no argument against it. In some cases it offers a good chance for complete regression; in others it inhibits the growth and aids in relieving symptoms; and, in all but the group of very advanced cases, where any radical procedure is contra-indicated, it offers some hope of temporary relief, thereby rendering the remaining period of life more tolerable.

Speaking of the cancer patient's general condition before, during and after treatment—Whatever the patient's present method of life, alter it by (1) Insisting on a gradual increase of muscular activity. Forbid the constant use of the motor car, encourage golf, walking, gardening, wood-chopping, or calisthenics. If the patient is unable to do these things urge the use of "resistance exercises in which the patient while lying or sitting quiet contracts vigorously a set of flexors resisting their action by a simultaneous contraction of their opposing extensors." Thus the use of all the muscles of the body can be brought about. This is the main idea in a "System" well advertised and sold for a hundred dollars.

(2) Cut down and alter the diet, not as a temporary measure but as a continuous habit of life. I do not think the bulky non-proteid diet drastic enough for a disease so intensely active as carcinoma. I would urge the profession to adopt the following intensive diet: Three pints of vegetable juice daily, one and a half pints of fruit juice daily, raw vegetables and fruits ad libitum, ground or scraped, if necessary to make them digestible, and so mixed as to make them palatable, even delicious; stewed and cooked vegetables and fruits, sugars, starches and syrups, cereals, bread and cakes, pies and jellies, enough to fill out the day's need. Forbid proteids.

Technique for Preparing Radium Tubes and Needles

for

Therapeutic Use

BY

WILLIAM H. CAMERON, M. D.
Pittsburgh, Pa.

Technique for Preparing Radium Tubes and Needles
Explanation of Terms Used—Equipment
—*William H. Cameron, M. D.*

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Part I

Part No. I.

Explanation of Terms Used

Radium Tube. Glass tube in which radium is sealed.

Protective Capsule. The silver or other metal in which the glass radium tube is placed.

Screen. Metallic or non-metallic material of sufficient thickness to filter primary and secondary beta rays.

Distance Screen. All non-metallic material used over and above the necessary amount employed to filter the secondary beta rays.

Applicator. The radium screened ready to apply.

Carrying Case. The heavy metal container in which radium is transported or stored.

Equipment Suggested

Silver Protective Capsule of 0.5 mm. wall thickness, absorbing 97% of the hard beta rays for 25 and 50-milligram tubes. (Plate No. 1.)

Radium Needle of 0.4 mm. wall thickness, absorbing 87% of the hard beta rays. (Plate Nos. 2 and 10A.)

Brass Screw-Cap Screens of 1.0 mm. wall thickness for use over protective capsule and radium needles. This additional metal completely absorbs hard beta rays. (Plate Nos. 1 and 2.)

Hard Rubber Shells of 2.0 mm. wall thickness. (Plate No. 3.)

Soft Rubber Tubing of from 0.5 to 3.0 mm. wall thickness.

Operator's Protection Stand (Plate No. 4). Recent experiments in this country and in England demonstrate that radium should always be handled with the protection such a stand will afford. It may be made with two-inch thickness of lead or three-inch thickness of iron. The stand as illustrated will absorb 89% gamma rays backward and downward and 95% on a downward and backward angle between the upright and bottom sections. This stand also has holes bored in upright section to protect hands when a number of needles are to be threaded.

Sliding-Spring Tube Forceps (Plate No. 5). In handling radium capsules and needles, a locking forceps must be employed which will grasp and hold firmly, but without risk of breakage. Radium tubes or needles should not, under any circumstances, be held in the fingers.

Push-Spring Needle Pick-up (Plate No. 6). Admirable for picking up needles.

Cameron Forceps (Plate No. 5). Radium capsules or needles while being screened should never be held in the fingers. The Cameron forceps will pick up and firmly grasp metal screens while inserting the radium capsules or needles and while placing the rubber or other non-metallic screening over the metal tubes.

Pith Wood. Workable pith wood, easily carved into flat screens, applicator caps, etc., etc.

Silk Thread. No. 1 Braided silk needle thread.

Needle Forceps for Placing Needles in Tissues (Plate No. 7). Radium needles being hollow, it is essential that a specially devised forceps be employed when introducing. The great desirability of avoiding breakage, etc., in using radium needles, the necessity of giving them minimum dimensions with necessary limited mechanical strength makes it imperative, where they are to be employed in dense tissues, that a way be made for the needle by means of a cataract knife or trochar, after which the needle can be easily inserted.

Bowen Needle Frame (Plate No. 8). Needles should be threaded and ready for introduction. This frame is designed to hold needle while being threaded and to have in readiness for use. It can be sterilized. Its use avoids delay from tangled threads, etc., and acts as a check when removing needles. Recommended for use when three or more needles are employed by the operator. (See part on Buried Needles.)

Technique for Preparing Radium Tubes and Needles

Universal Tube Applicator

—*William H. Cameron, M. D.*

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Part I

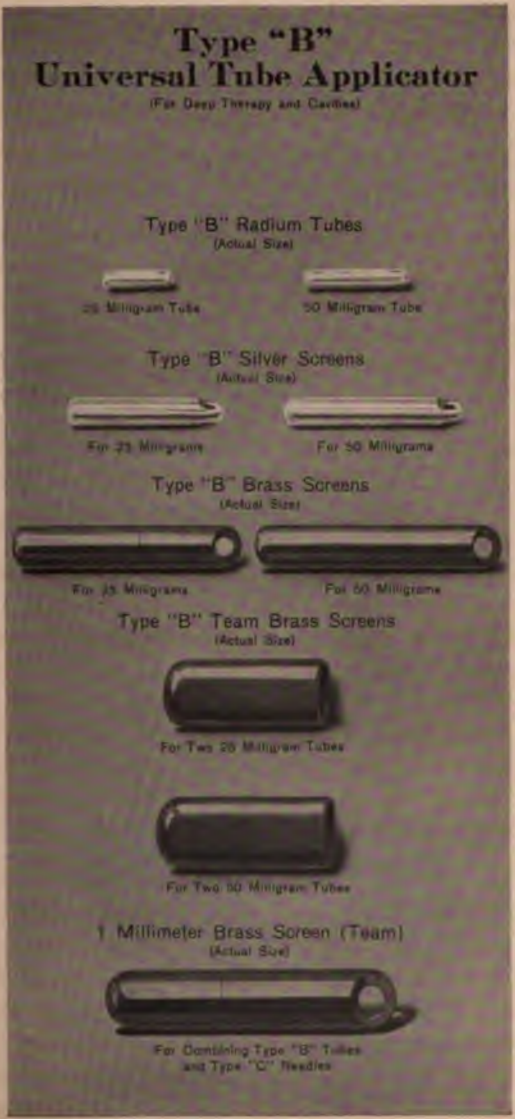
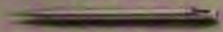


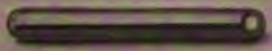
Plate No. 1

Type "C"
Needle Applicator

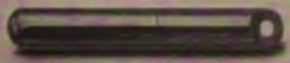
Type "C" Needle Applicator
(For Introduction Into Tissue)
(Actual Size)



Screen for Use As Type "B" Applicator
(Actual Size)



Team Screen for Two Needle Applicators
(Actual Size)



Leather Carrying Case With Metal Container

Plate No. 2

Technique for Preparing Radium Tubes and Needles

Hard Rubber Shell Applicator
Operator's Protection Stand

—*William H. Cameron, M. D.*

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Applicato

Part I

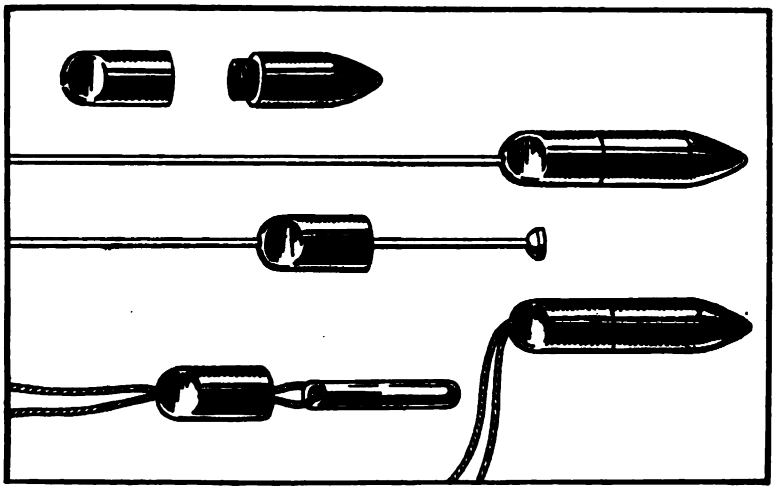


Plate No. 3

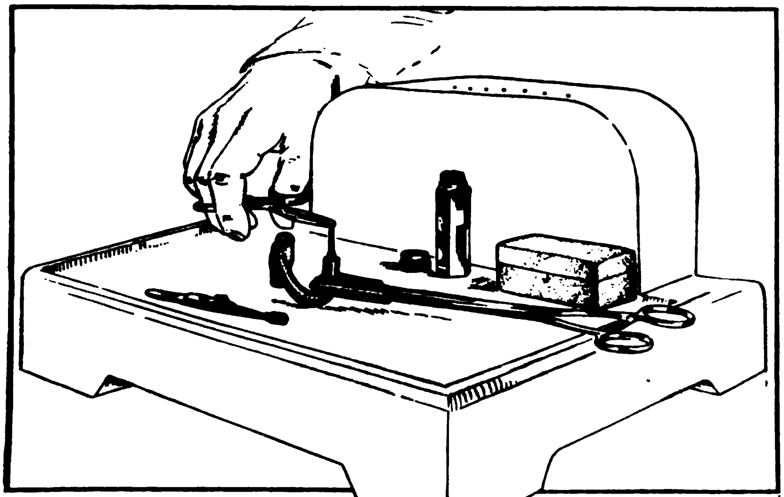
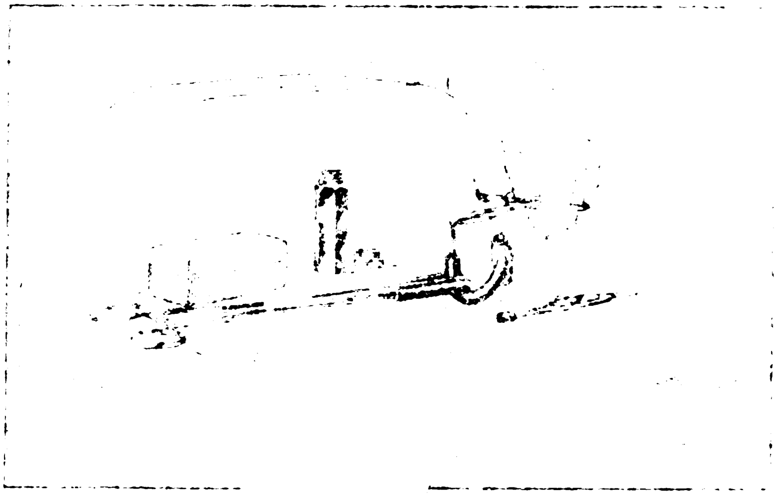


Plate No. 4



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Technique for Preparing Radium Tubes and Needles

Sliding Spring Tube Forceps
Cameron Forceps
Push Spring Needle Pick-up

—*William H. Cameron, M. D.*

FILE UND

Applicator

Part I

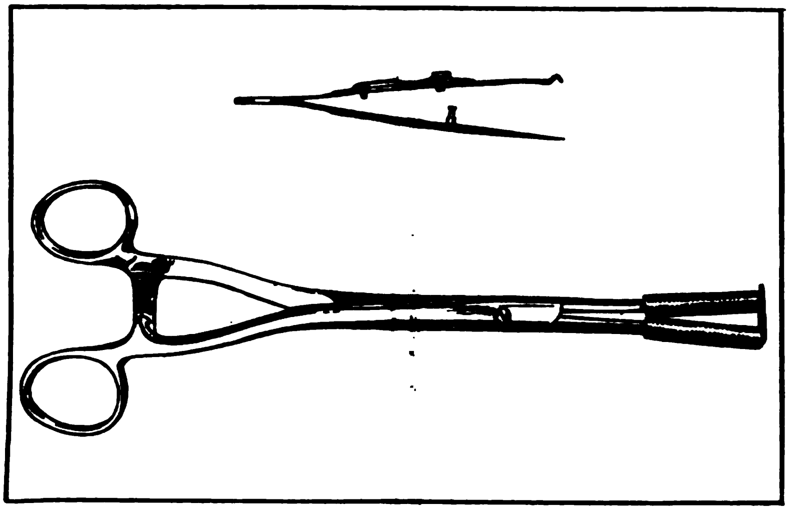


Plate No. 5

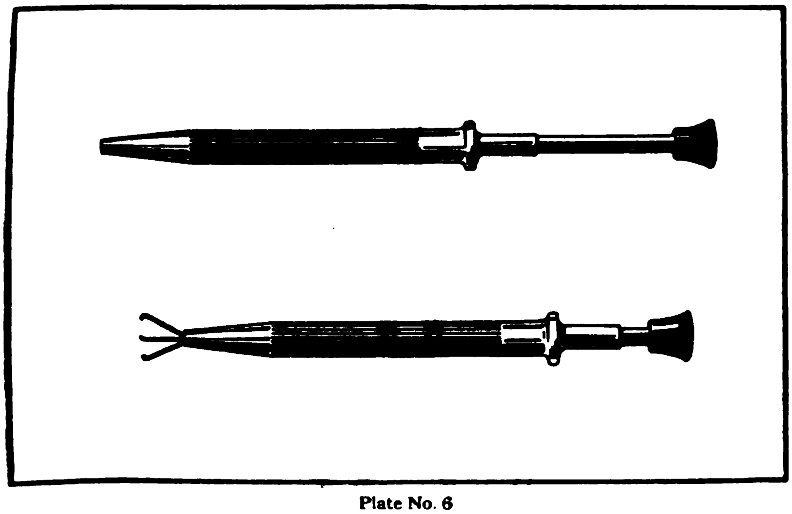
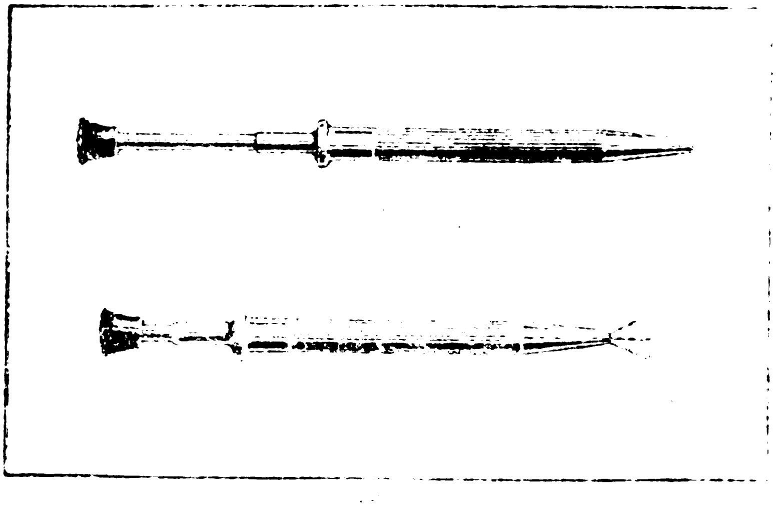


Plate No. 6



Technique for Preparing Radium Tubes and Needles

Forceps for Introducing Needles

—*William H. Cameron, M. D.*

FILE UNDER
Applicators

Part 1

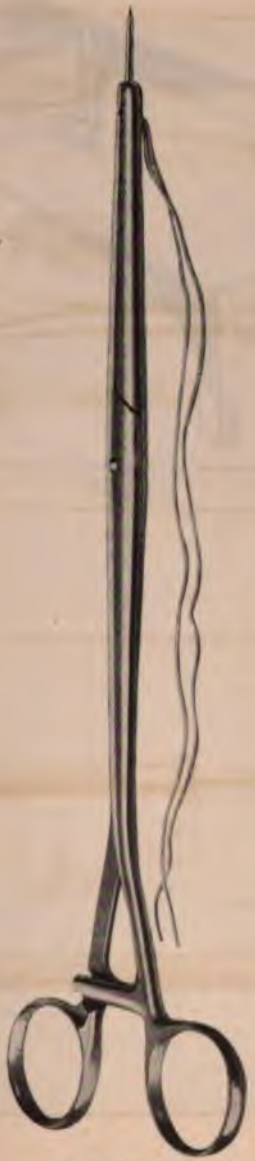


Plate No. 7

Technique for Preparing Radium Tubes and Needles

Bowen Needle Holder

—William H. Cameron, M. D.

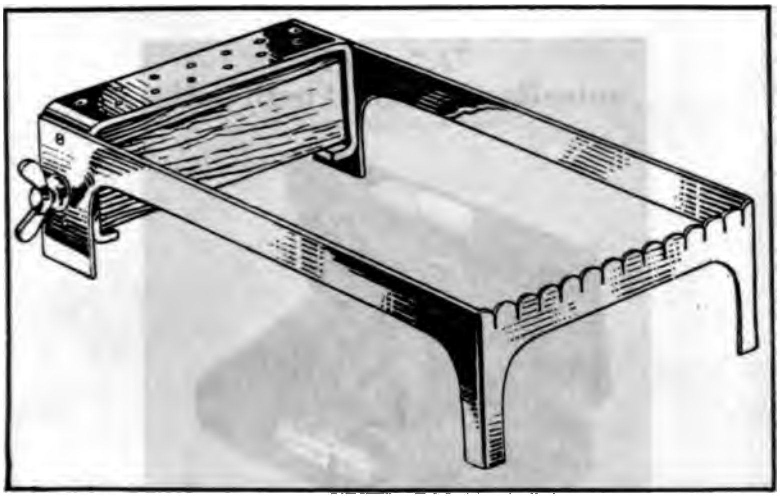
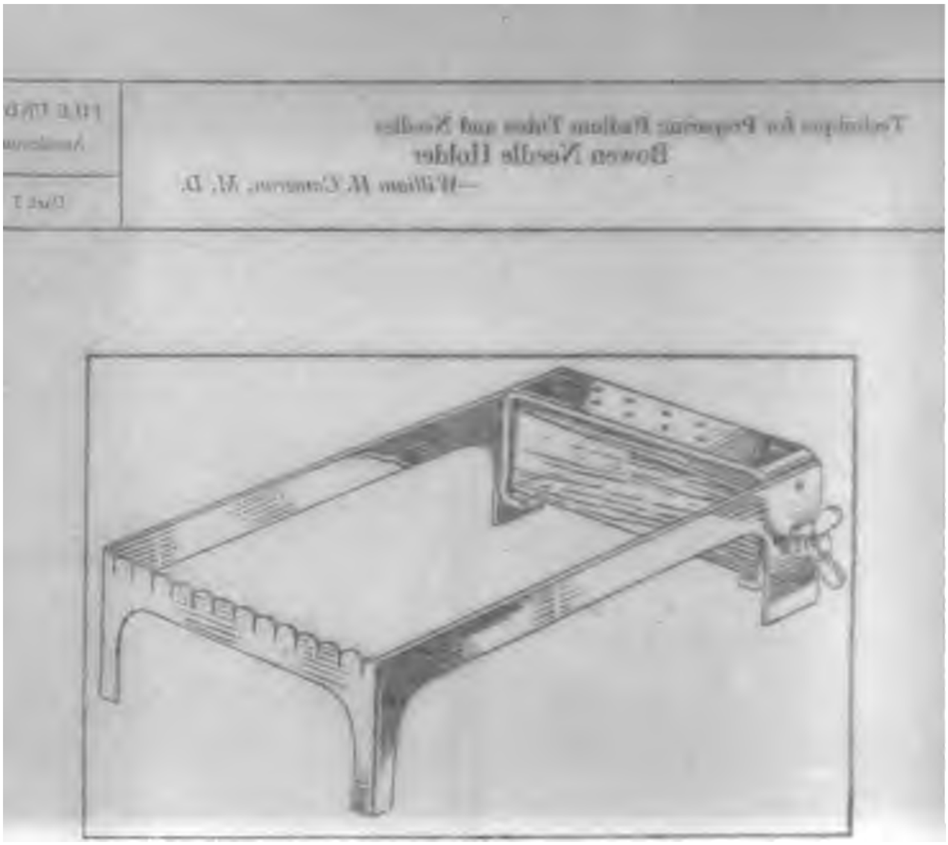


Plate No. 8



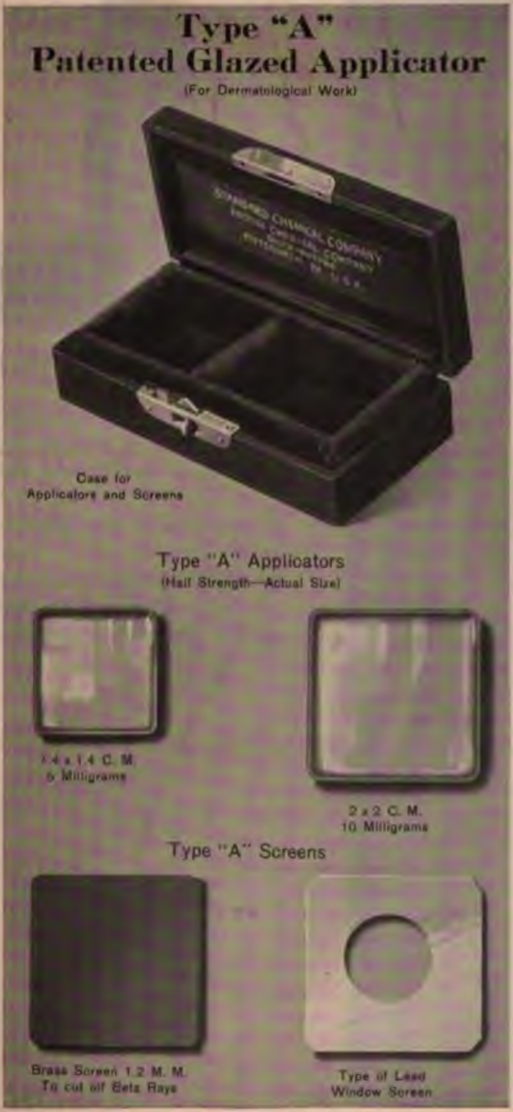

Type "A"
Patented Glazed Applicator
(For Dermatological Work)
STANDARD CHEMICAL COMPANY
Case for
Applicators and Screens
Type "A" Applicators
(Half Strength—Actual Size)
1.4 x 1.4 C. M.
5 Milligrams
2 x 2 C. M.
10 Milligrams
Type "A" Screens
Brass Screen 1.2 M. M.
To cut off Beta Rays
Type of Lead
Window Screen

Plate No. 9

Lee Type Needle Applicator

—William H. Cameron, M. D.

Plate No 10-B

- **A.** Radium Needle.
- **B.** Removable Screw-Cap with Eye.
- **C.** Removable Screw-Shaft with Knob End.
- **D.** Radium Needle with Eye Screw-Cap in place.
- **E.** Brass Screen of 1 mm. wall thickness, to hold Radium Needle A.

Above Container for Radium Needle.

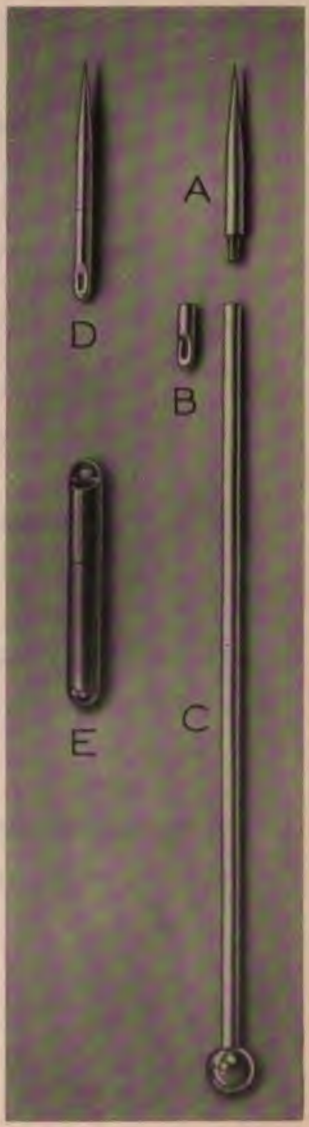


Plate No. 10-A

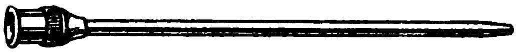
Technique for Preparing Radium Tubes and Needles

Canula and Trocar for Use in Introducing Standard Needle

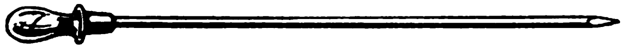
—William H. Cameron, M. D.

FILE UNDE
Applicator

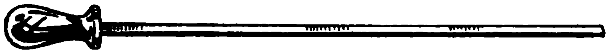
Part I



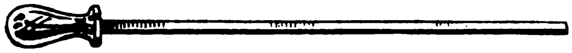
Canula.



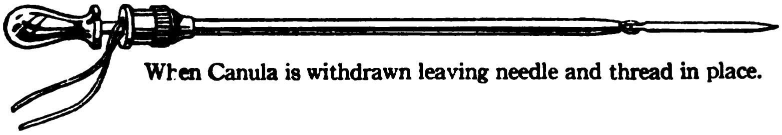
Trocar.



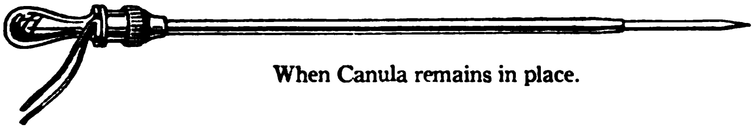
Long Plunger for introducing needle free of Canula.



Short Plunger for introducing needle to end of Canula only.



When Canula is withdrawn leaving needle and thread in place.



When Canula remains in place.

The Cameron Adjustable Self-Retaining Radium Applicator for Mouth, Tongue, Tonsil and Throat.

(Patent Applied For)

1. Radium Container and Screen (adjustable to various angles) for four needles of 12.5 milligrams each, or, five 10-milligram needles, side by side. This container is fastened on end of No. 6 at "A" by screw-joint.

2. Radium Container and Screen (adjustable to various angles) for two 25-milligram tubes, side by side. This Container is fastened on end of No. 6 at "A" by screw-joint.

3. Radium Container and Screen (adjustable to various angles) for one 50-milligram tube. This Container is fastened on end of No. 6 at "A" by screw-joint.

4. Slip-on Holding Device (adjustable to various angles) for a specially devised plaque (see No. 5.) This device is fastened on end of No. 6 at "A" by screw-joint.

5. Specially designed two and one-half strength, flat-surfaced, round, glazed plaque containing 25 milligrams of radium element. Outside diameter 10 mm. The applicator may also be utilized for superficial applications.

6. Adjustable handle for radium containers. This handle is so constructed that by turning "B", the point "A" may be adjusted and locked at various angles. At "C" the handle is perforated so that it may be held (by pin) in mouth piece of holding apparatus. At "D" is an arrangement for attaching rubber band to make gentle or strong pressure of radium containers 1-2-3-4 against the part being rayed. The other end of rubber band is attached to mouth piece of holding apparatus.

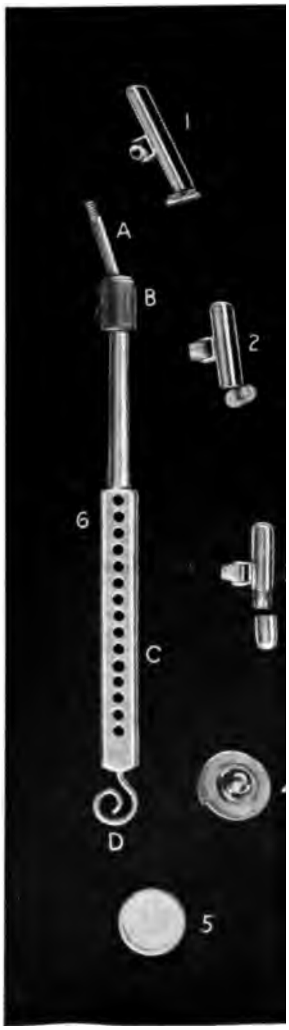


Plate No. 11.

The Cameron Adjustable Self-Retaining Radium Applicator for uth, Tongue, Tonsil and Throat.

(Patent Applied For)

Showing at (1) soft leather head-band and non-slip buckle (2). Adjustable cheek-plate at (3), adjustable by means of thumb screw (4) upward and downward, forward and backward. Connecting rods (6) adjustable forward and backwards by means of thumb screw at (5), and in and out by reason of joint at (6a). Mouth piece (7) adjustable to any angle by means of ball and socket joint on (6) and fixed by thumb-screws at (8). Upper plate (7) of mouth piece perforated to accommodate locking pin (10) pin also passing through perforations in handle of radium container (Plate No. 11). Lower plate of mouth piece (9) hinged so as to drop down while radium container is being introduced. After pin is placed this plate is locked in position as shown in Plate No. 13.

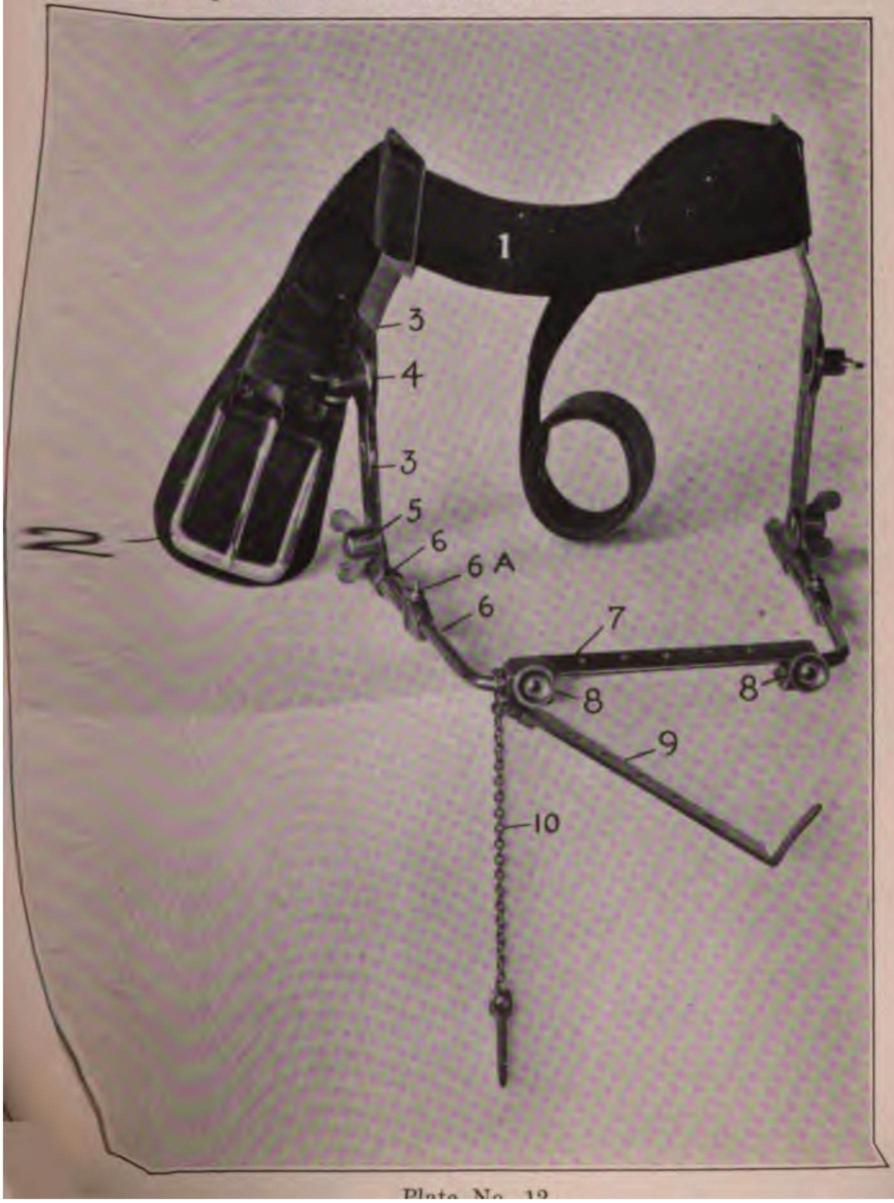


Plate No. 12

neron Adjustable Self-Retaining Radium Applicator for ue, Tonsil and Throat.
(Patent Applied For)

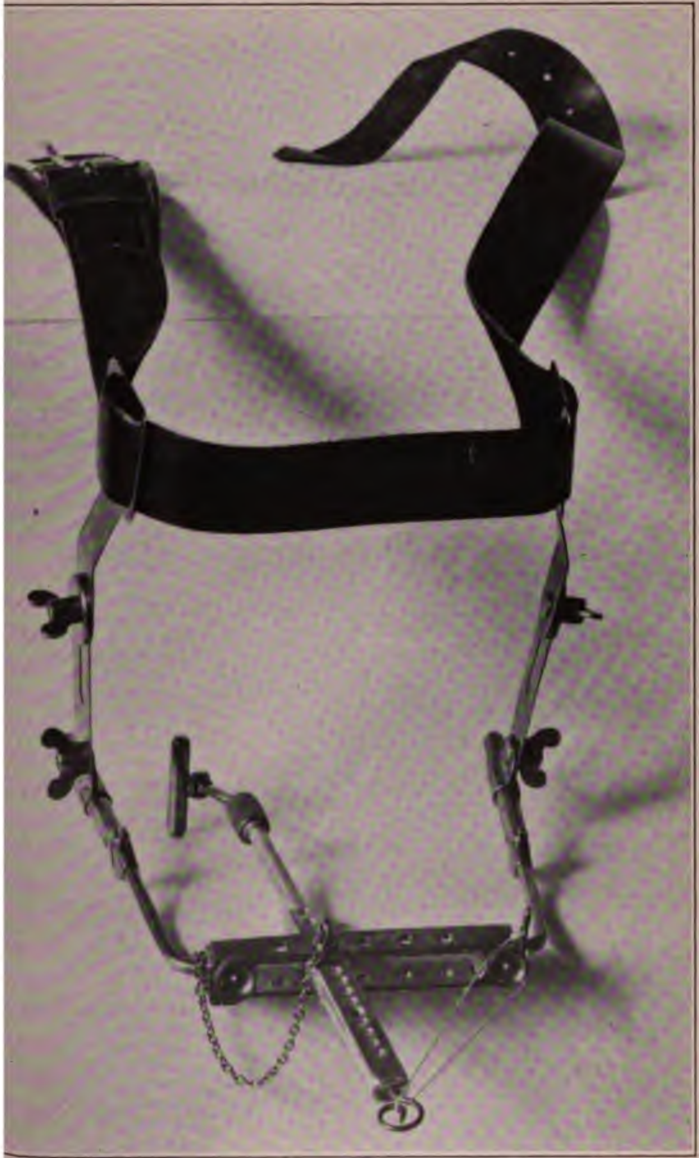


Plate No. 13

lowing holding device, radium container and handle assembled.

ubber band fastened on "d" of Plate 11 and either side of mouth to make pressure of radium container against part.

he brass end of handle ("A" and "B" of Plate No. 11) is covered hin rubber tubing.

The Cameron Adjustable Self-Retaining Radium Applicator for outh, Tongue, Tonsil and Throat.

(Patent Applied For)

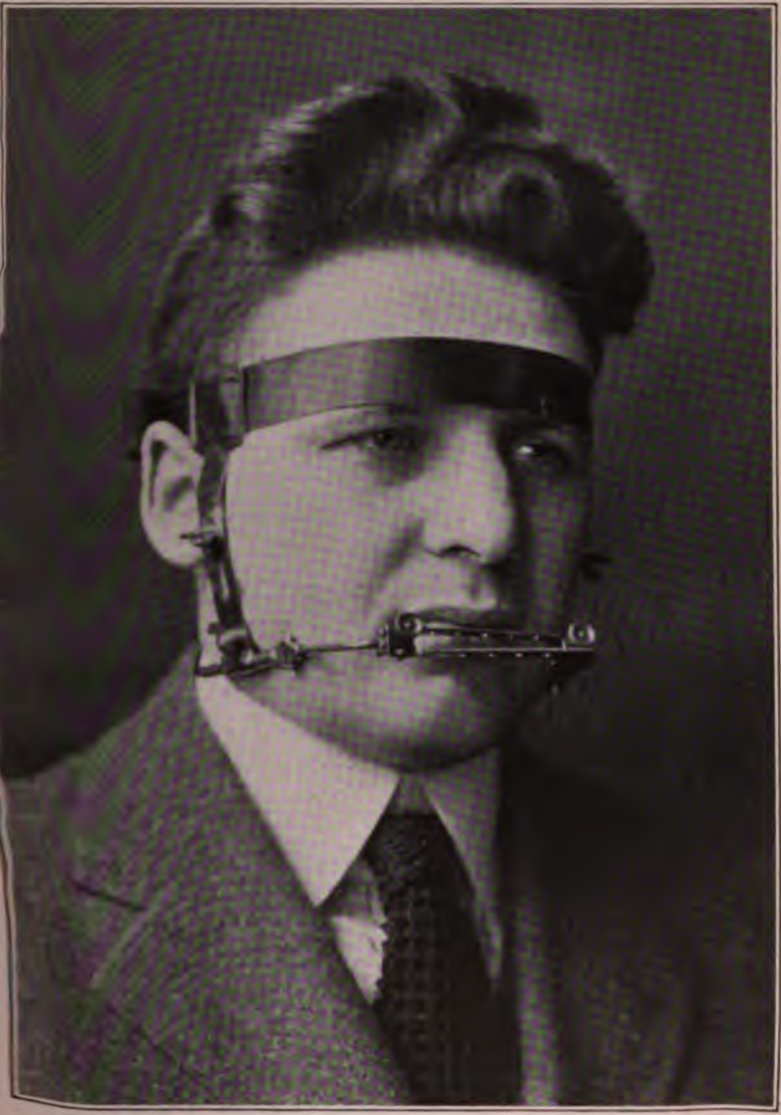


Plate No. 14

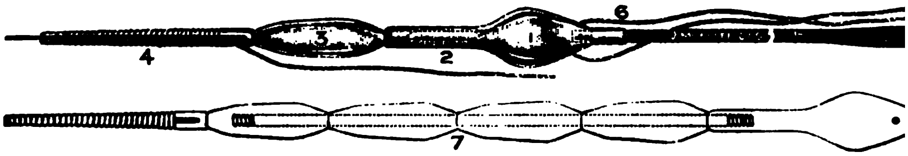
Showing adjustment of apparatus before lower plate (9 of Plate No. 12) is dropped to introduce radium container and handle. The upper plate (7 of Plate No. 12) should be adjusted on a line with lower margin of upper teeth. Adjust holding apparatus before using local anaesthetic.

Cameron, Wm. H., M.D. "Technique for Preparing Radium Tube and Needle Applicator for the Oesophagus.

FILE UNI

Applicato

Part 1



Designed by Dr. Vincent, Chicago.

No. 1. Large olive to prevent slipping through constriction.

No. 2. Hollow tube for carrying radium containers. This is permanently attached to No. 1.

No. 3. Various size olives to pass beyond construction. One selected held in place by slipping over shaft of No. 4 which screws into lower end of No. 2.

No. 4. Flexible spiral spring guide.

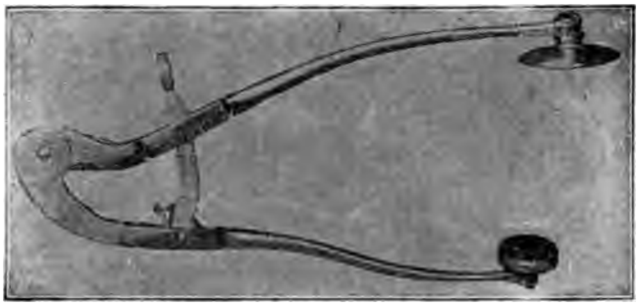
No. 5. Whale-bone shaft for introduction. Fits into upper end of No. 1 and easily released after placing.

No. 6. String for fastening and removing.

No. 7. Method of assembling instrument when not in use.

**Swanson, Cosby, and Wm. H. Hailey, M.D., Atlanta, Ga. "Self-
etaining Radium Holder for Tonsil Work. Jour. A. M. A., April
5th,** 1922, p. 1125.

When we began to use radium for selected cases of hypertrophied and infected tonsils, great difficulty was experienced in getting patients to hold the radium against the tonsil. It occurred to us that a tonsil hemostat could be used for this purpose.



Self-retaining radium holder for tonsil work.

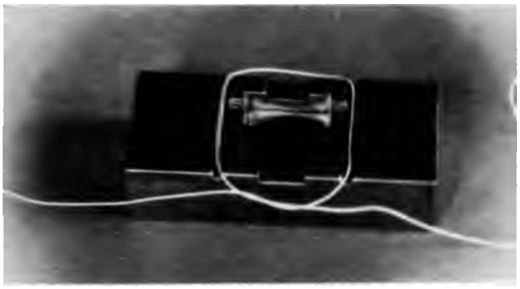
The spring clamps to hold the gauze pad and the knob were removed from the inner blade of a Corwin tonsil hemostat. The hole in the inner blade was enlarged so as to fit the peg on a 30 mg. oval radium plaque. A rubber cot was placed over the radium and inner blade, and the device was then ready to be placed in position.

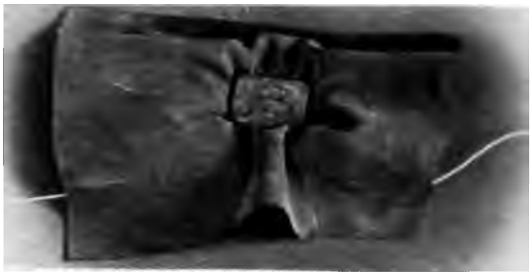
Cameron, William H., M. D.: Technique for Preparing Radium bes, Needles and Plaques. "The Cameron Screening Block for ques."

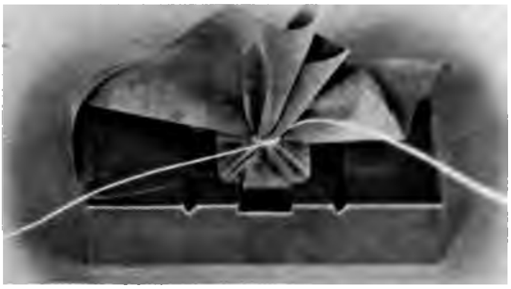
This abstract is made of a very handy and simple screening aid for flat surface applicators or plaques.

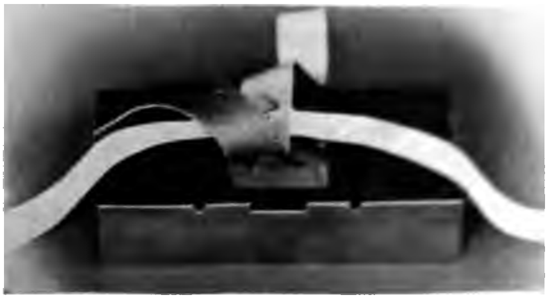
The use of this block obviates the handling of plaque in screening with metallic screens, placing thin rubber over the plaque, or of attaching adhesive plaster to the applicator after it has been screened.

Its use is recommended, because digital exposure to the beta and gamma rays from this type of applicator is particularly dangerous









Cameron, William H., M. D.: Technique for Preparing Radium ubes, Needles and Plaques. "The Cameron Screening Block for laques."

FILE UND
Applicators

Part 1.

Announcement is made of a very handy and simple screening block for flat surface applicators or plaques.

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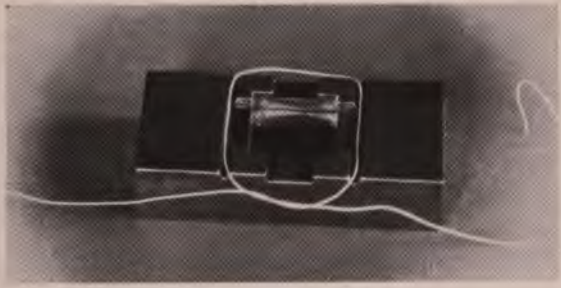
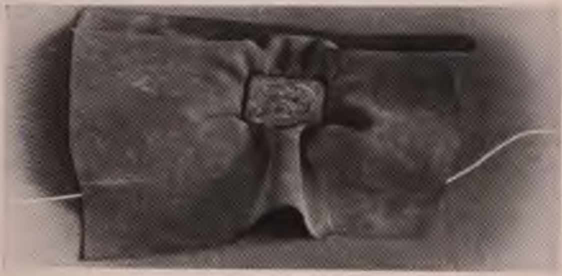
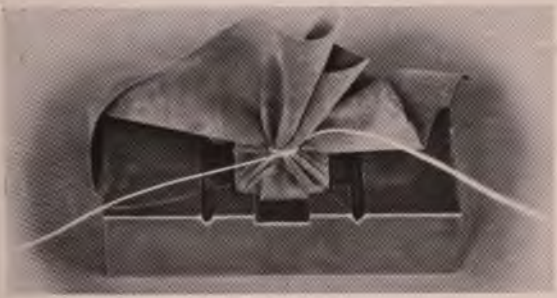
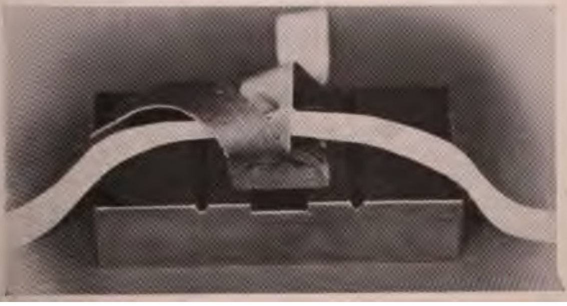
Its use is recommended, because digital exposure to the beta and gamma rays from this type of applicator is particularly dangerous.









Part No. II.

FOREWORD

THE auxiliary instruments employed in handling radium, the necessary filtering and distance screens used and the technique adopted in preparing applicators should make for simplicity in application, and every step in the handling must afford the operator the greatest possible protection.

Generally speaking, I believe it is better technique to construct applicators for the individual case rather than to use an alleged universal applicator. I also believe that better results will be obtained when a few easily constructed and well understood applicators are employed. A large array of complicated and expensive screens and applicators gives a sense of security not always obtained, and frequently, through inflexibility, they fail in the purpose for which they are constructed. Necessary screening should never be sacrificed to secure ease in application unless for a desperate case wherein compactness in the applicator must be had in order to avoid manipulation and trauma and when "after effects" are of secondary consideration.

The use of buried needles is recommended wherever practicable—this because of the better utilization of the available rays. Before deciding on the use of needles, the operator must be able to discount the trauma caused by their introduction as against the possible amount of irritation (reaction) produced by surface raying.

Radium is not, for all practical purposes, a germicide; consequently, capsules, needles and applicators are capable of carrying infection. Radium tubes and needles should be dipped in ether or benzine for cleansing purposes after using and in phenol, lysol, formalin, alcohol, etc., for sterilizing purposes. Metallic and rubber screens may be boiled. I have seen many capsules and needles so coated with dried secretions that it was with difficulty that they would slip in and out of their screens.

In taking radium applicators apart, the same precautions in handling the radium must be observed. This rule should cover the act of placing the radium in its large carrying case (Plate No. 125).

In transporting radium, it should **never** be carried on the person. Since a metal carrying case capable of absorbing most of the gamma rays would require the placing of from three to five inches of lead around the radium, it is clear that such containers would be excessively heavy (50 to 75 lbs.) and so protection is best had, after absorbing the softer radiation in a small metal carrying case, by keeping the radium at a distance of a foot or more from the person. This can be done by carrying the radium in the bottom of a bag.

The following points should be considered before screening and arranging the applicator:

1. **The Location of the Lesion.**
   Applicators should be arranged in order to reach the lesion with the least possible amount of manipulation.
2. **The Size of the Lesion and the Possible Amount of Induration Present.**
   The applicators should be distributed over the lesion for the best cross-fire effect. The indurated area should be included in the radiation, for it is in this indurated area where young active cells are found. Frequently the applicator must be moved from one location to another. To do this with the least amount of disturbance is a point to consider in selecting the type of applicator.
3. **Precautions Must be Taken to Avoid Damage to Healthy Surrounding Tissue and Organs.**
   It is possible, in many cases, to combine materials—"to wall off" healthy tissue—with the radium applicator, thus avoiding additional manipulation.
4. **Avoid Friction.**
   Where necessary to place an applicator in one position for a long period of time, friction, and consequently irritation, is to be avoided, especially in malignancy. The applicator should be so constructed that precaution is had against all possible irritation that may be caused by the applicator itself.

5. **Possible "Distance Effect."**
   To prevent the full concentrated effect immediately surrounding the applicator, advantage should be taken of distance even when such distance amounts to but a few millimeters. In the uterine canal, a few millimeters, in addition to the normal screening employed, will materially lessen the annoying after effects of radiation.

6. **Tolerance of Patient.**
   This is a factor not to be overlooked and will enter into the construction of the applicator, the "dose" of radium employed and the length of time the applicator may remain in place.

7. **Rigidity or Flexibility of the Applicator.**
   An important factor when radium is to enter a canal or hollow organ, or when it is to be passed around or over an irregular mass: Applicators with a rigid staff should not be placed in the oesophagus, rectum, uterus or bladder. In other words, when the radium tube or needle is to be placed in one end of an applicator and this end is at a distance from the blind end, the end containing the radium should move with the part with which it is in apposition and not with or against the blind end that emerges from the cavity. Because of their inflexibility, many of the pretty instruments devised for a particular purpose are less useful than an improvised applicator prepared to fit the particular case.

8. **Blind Applications.**
   When possible to convert an internal lesion into an external one by a slight operation that will not disturb the lesion itself, it should be done in order to facilitate placing the applicator. (Cancer of the bladder is a good example of such technique.) When not possible, careful measurement should be made so that in constructing the applicator, the radium will be placed exactly where it belongs.

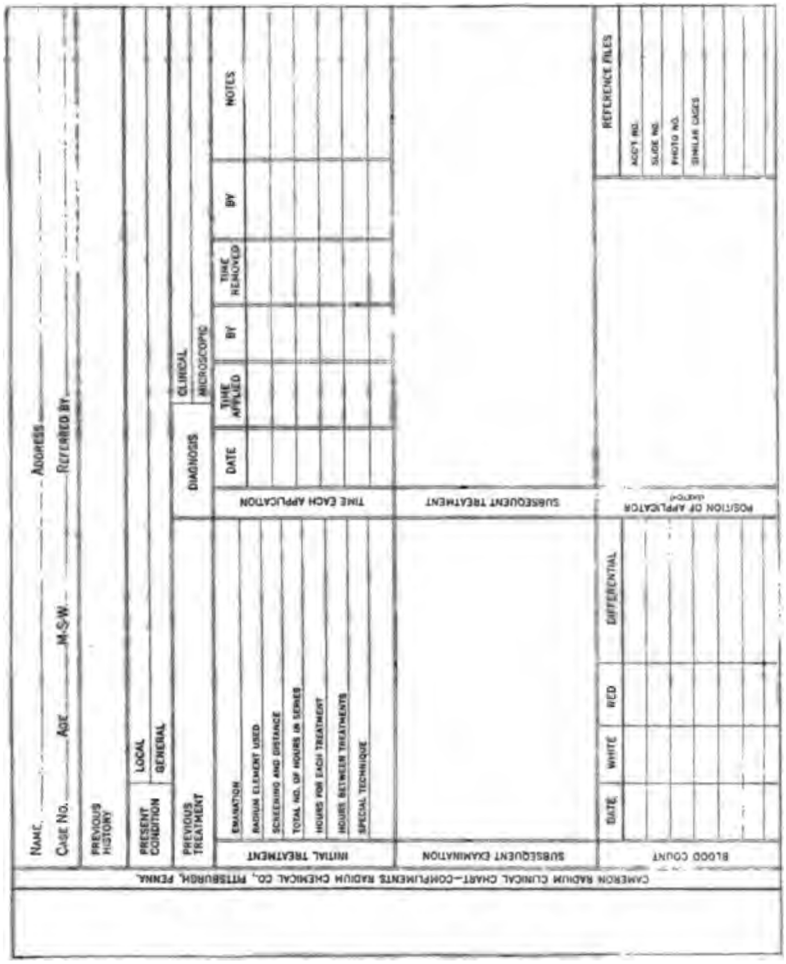
9. Reporting Treatment.

In reporting cases it is recommended that the following form be used:

Amount of Radium Element Used. (In flat applicators strength and dimensions of applicator.)
Amount of screening used.
Distance screening employed.
Hours for each treatment.
Interval between treatments.
Total number of hours in first series.
Subsequent treatments.
Time between first and second series, etc.

(See Page 15-B for sample Clinical Chart.)

Technique for Preparing Radium Tubes and Needles Foreword *—William H. Cameron, M. D.*	**FILE UNDE** **Applicators** **Part II**



NAME ____ ADDRESS ____

CASE NO. ____ AGE ____ M-S-W ____ REFERRED BY ____

PREVIOUS HISTORY

PRESENT CONDITION: LOCAL ____ GENERAL ____

PREVIOUS TREATMENT

DIAGNOSIS: CLINICAL ____ MICROSCOPIC ____

INITIAL TREATMENT
EMANATION ____
RADIUM ELEMENT USED ____
SCREENING AND DISTANCE ____
TOTAL NO. OF HOURS IN SERIES ____
HOURS FOR EACH TREATMENT ____
HOURS BETWEEN TREATMENTS ____
SPECIAL TECHNIQUE ____

TIME EACH APPLICATION

DATE	TIME APPLIED	BY	TIME REMOVED	BY	NOTES

SUBSEQUENT EXAMINATION

SUBSEQUENT TREATMENT

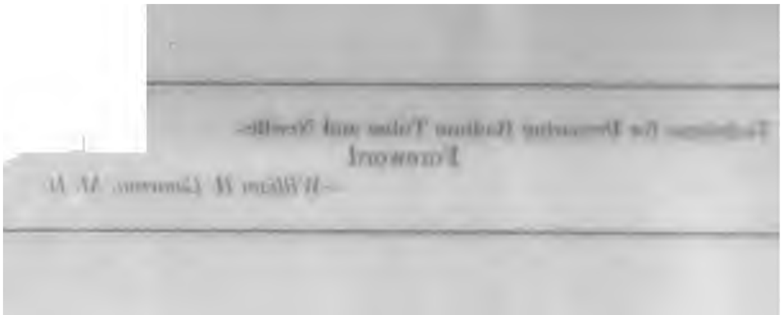
BLOOD COUNT

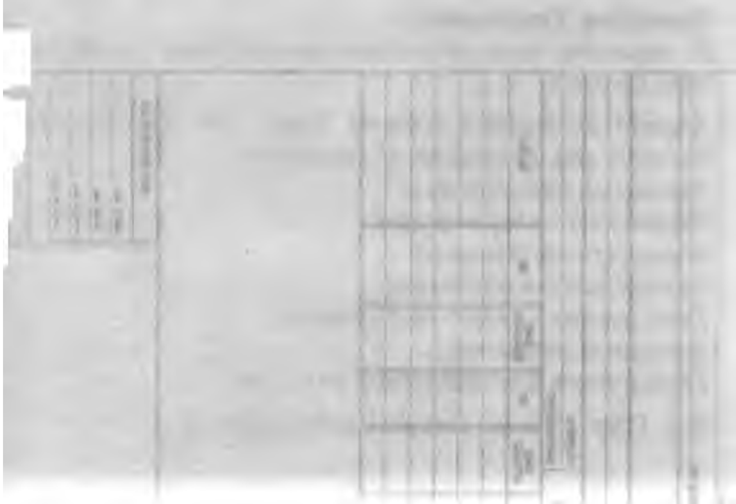
DATE	WHITE	RED	DIFFERENTIAL

POSITION OF APPLICATOR (SKETCH)

REFERENCE FILES
ACC'T NO. ____
SLIDE NO. ____
PHOTO NO. ____
SIMILAR CASES ____

CAMERON RADIUM CLINICAL CHART—COMPLIMENTS RADIUM CHEMICAL CO., PITTSBURGH, PENNA.





Part No. III

Technique for Arranging Hard Rubber Applicators

NOTE.—When it is desired to have a semi-flexible carrying holder for this applicator, copper wire covered with rubber tubing may be used.

When wire is used pass silk thread as per operation No. 3. Pass wire through same opening, and stitch ends of thread to end of rubber tubing.

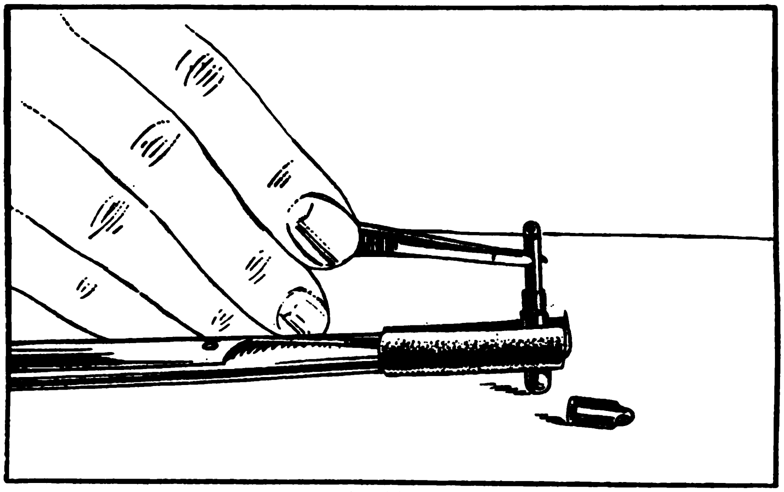


Plate No. 100

Operation No. 1

Silver capsule holding glass radium tube is picked up and held by sliding-spring forceps, the brass screen being held by the Cameron Forceps. The protective capsule is placed in the brass screen. Same operation for radium needle.

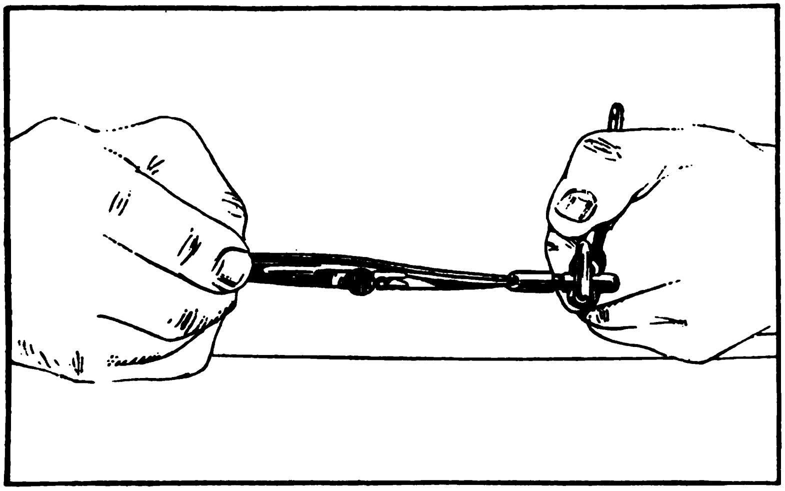


Plate No. 101

Operation No. 2

Screw-cap for brass screen is picked up and screwed into place *with sliding-lock* forceps.

Technique for Preparing Radium Tubes and Needles

Soft Rubber Cavity Applicators

—William H. Cameron, M. D.

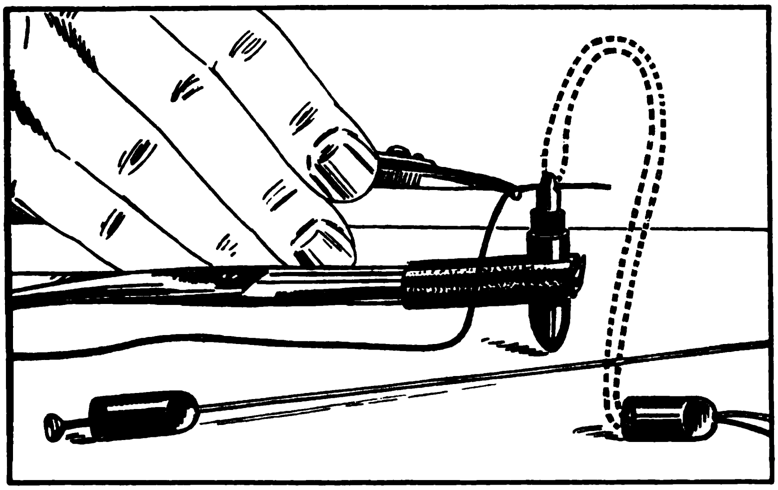


Plate No. 102

Operation No. 3

The brass screen containing the radium tube in its protective capsule is now released from the Cameron forceps; the hard rubber shell screen is picked up, and the brass tube with radium inserted, using the locking-forceps. Safety cord is now passed through the eye of the brass screen. Both ends of the cord are then threaded through opening in cap of the hard rubber screen after which the ends are tied. The rubber cap is then slipped down on the thread and screwed on to the base of the hard rubber shell. Fairly heavy cord may be used and it must be long enough so that the fingers may be held away from the applicator when tying. Sterilized bees-wax on end of cord will assist in passing through the eye of the brass screen and the opening in the rubber shell.

Operation No. 4

In picking up and placing this applicator, it may be held at beveled edge with a pair of straight or curved uterine forceps.

Technique for Arranging Soft Rubber Cavity Applicator

NOTE.—It is for the most part desirable to use a large amount of radium (two to six needles, or several radium tubes and needles) carrying a correspondingly large screen and it is impossible to place the screen into the lumen of the rubber tubing without using the hands. Therefore, the tube is cut and sutured together. With a small amount of radium and a correspondingly small screen, the applicator may be made by fastening a piece of stout string in the eyelet of the brass screen and pulling into the lumen of the rubber tubing, then tying rubber tubing at both ends of brass screen to prevent slipping.

NOTE.—It is possible to obtain rubber tubing with rounded blind end, thus obviating the use of caps.

Technique for Preparing Radium Tubes and Needles

Soft Rubber Cavity Applicators

—William H. Cameron, M. D.

FILE UND

Applicator

Part III

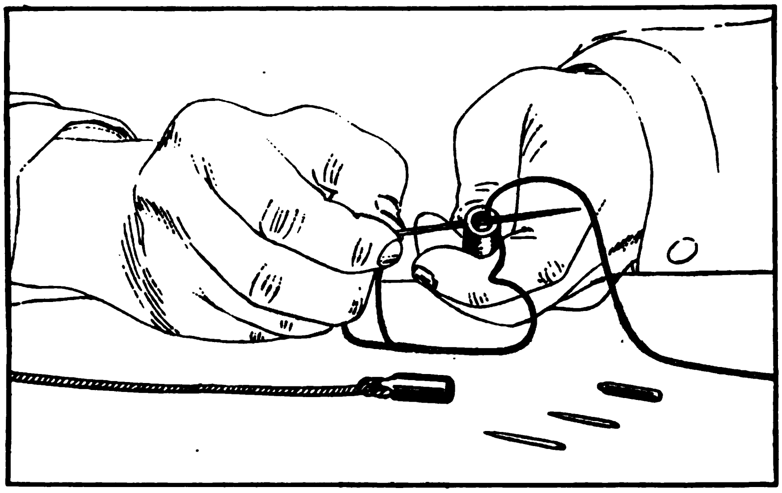


Plate No. 103

Operation No. 1

Screw-cap for brass screen (in this case two needles of 12.5 milligrams each and one 25-milligram tube are used) is threaded with safety cord. Rubber tubing of proper length (length obtained by actual measurement) and thickness selected. With ordinary darning needle suture is placed from the surface to the lumen of tube, about one-fourth inch from the end. The end of the suture is now passed from the surface to the lumen on the opposite side of tube and the ends pulled taut.

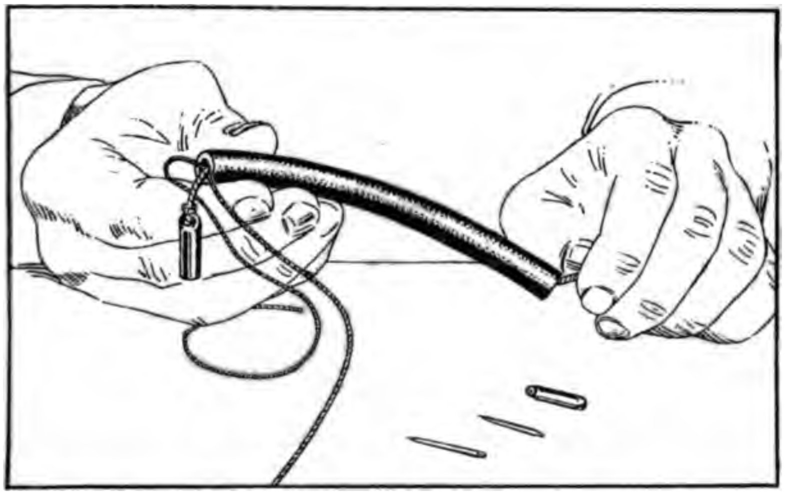


Plate No. 104

Operation No. 2

Safety cord is drawn through long end of rubber tubing and *screw-cap* drawn into end of tube.

Technique for Preparing Radium Tubes and Needles

Soft Rubber Cavity Applicators

—William M. Cameron, M.D.

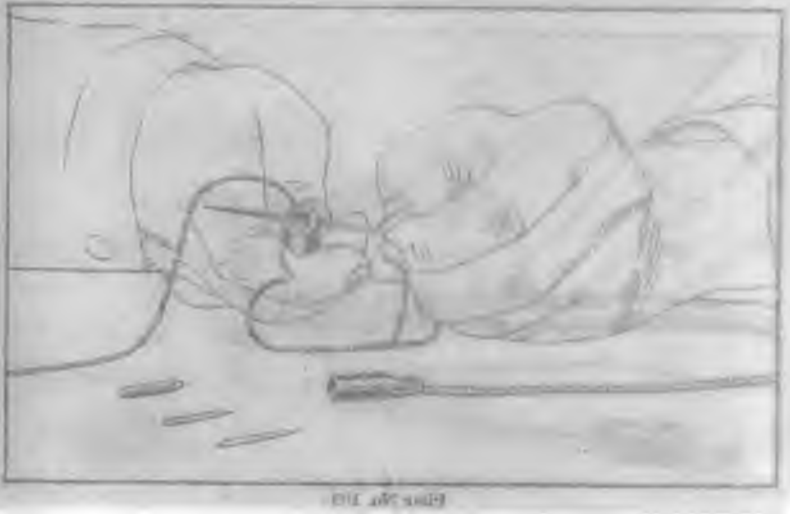
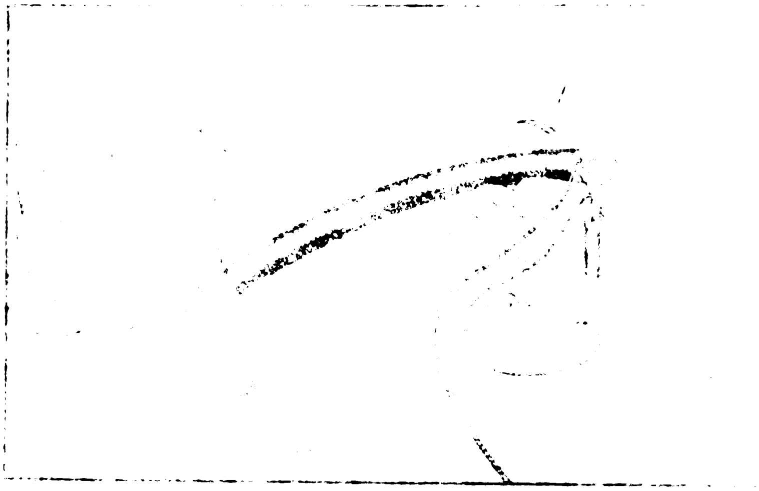


Plate No. 103



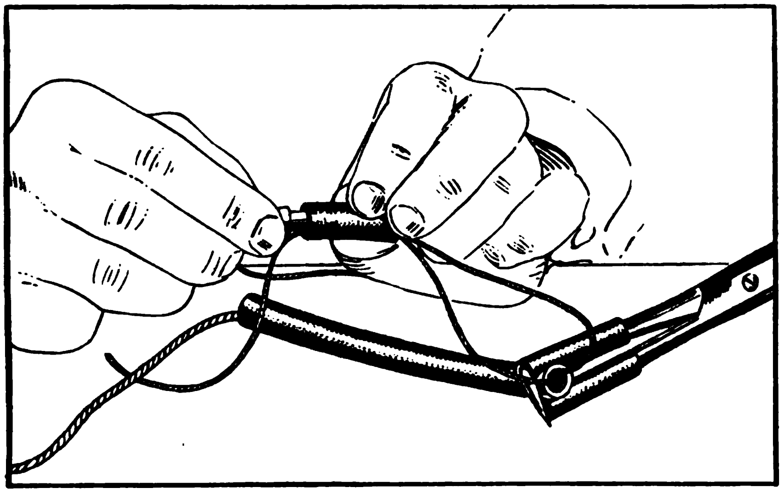


Plate No. 105

Operation No. 3

The short piece of tubing is now selected (the long and short pieces of rubber should represent the entire length of the applicator with provision made for cap) and sutures from long length of tubing passed through it. If necessary, for more ease in placing, a small cap (carved from pith wood) is inserted into the lumen of the short tubing. This cap must also enter into the length of tube when placed in blind cavity.

Aluminum caps to fit rubber tubing may now be had.

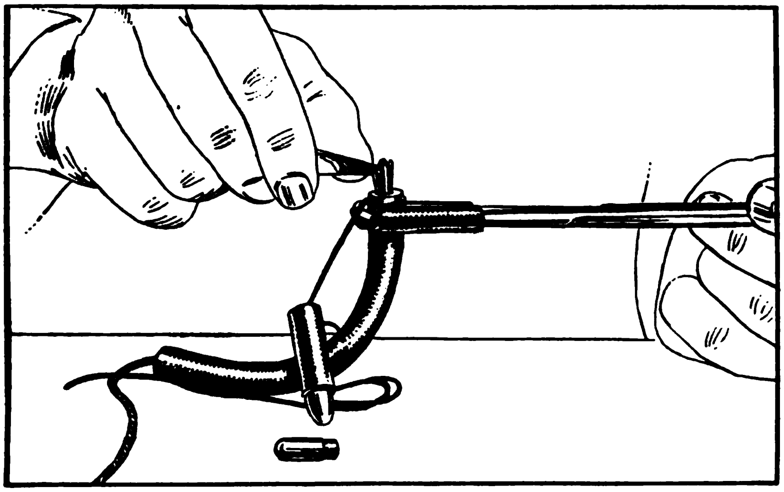
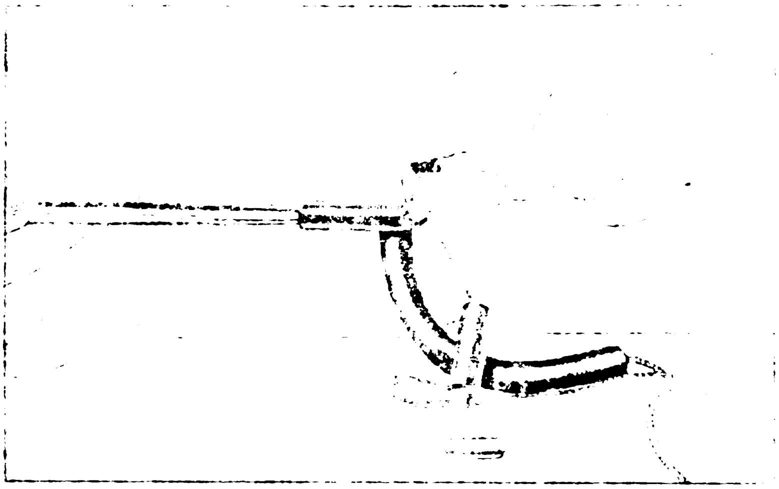


Plate No. 106

Operation No. 4

The long piece of tubing containing screw-cap is now held in *Cameron Forceps* and radium tube and needles placed with *sliding-lock forceps.*



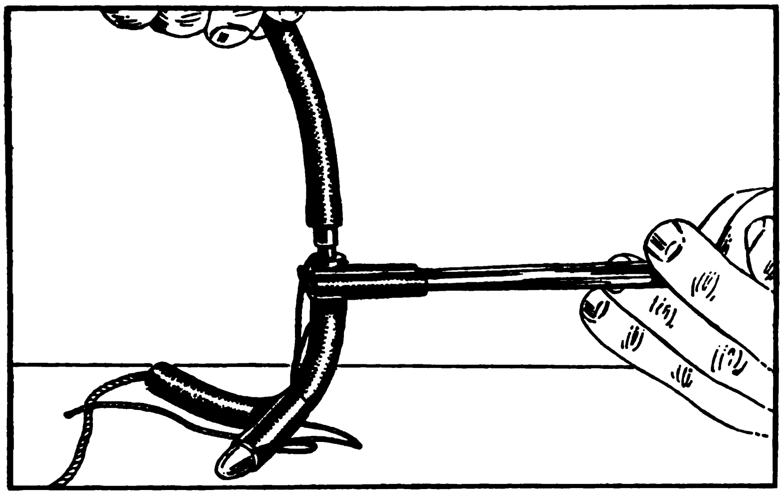


Plate No. 107

Operation No. 5

The brass screen (held in piece of rubber tubing) is now screwed into place.

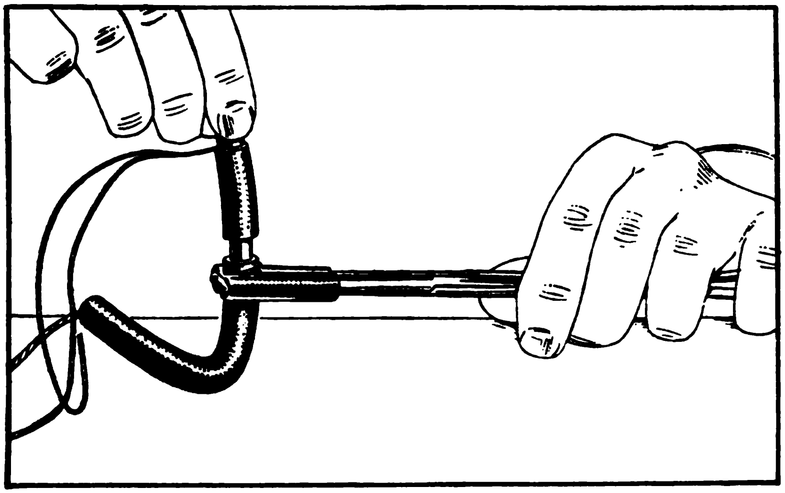


Plate No. 108

Operation No. 6

Short piece of rubber tubing with its pith wood cap is now placed over brass screen.

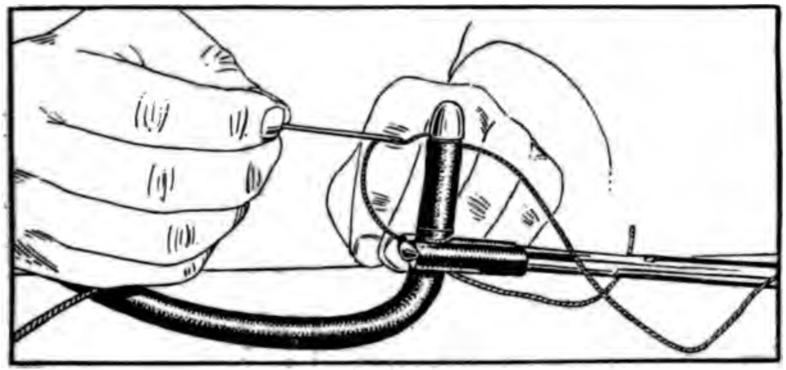


Plate No. 109

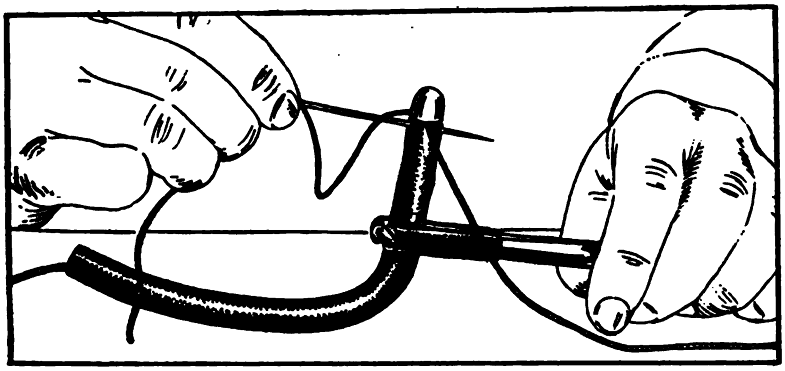


Plate No. 109-A

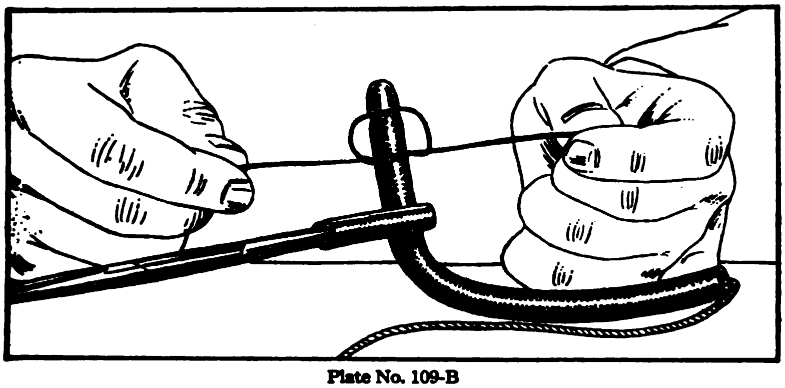


Plate No. 109-B

Operation No. 7

The suture attached to end of long section of rubber and passing through the lumen of the short section is threaded on a long darning needle and plunged through tubing and hole previously drilled through the pith wood cap, drawn taut and tied.

Technique for Preparing Rubber Tubes and Needles

Soft Rubber Cavity Applicators

William R. Cameron, M.D.

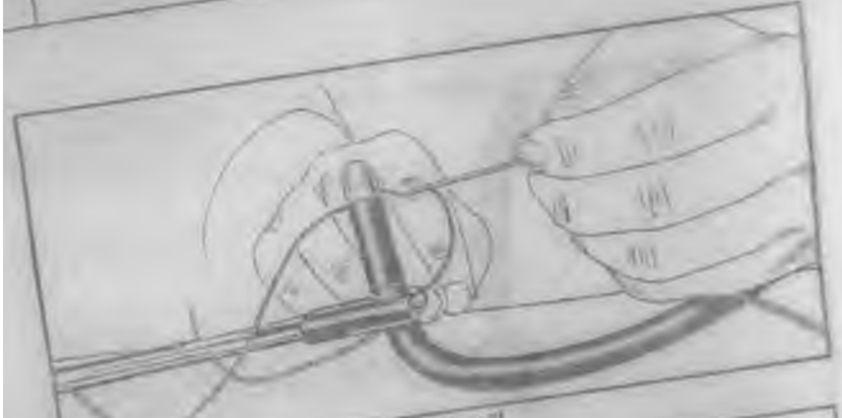


Plate No. 108

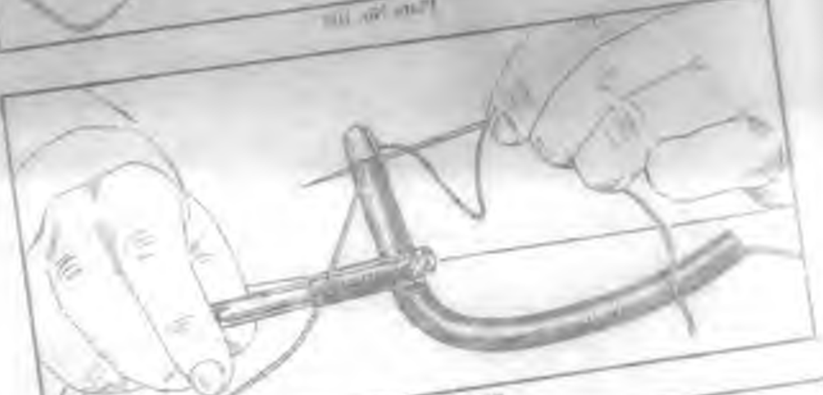
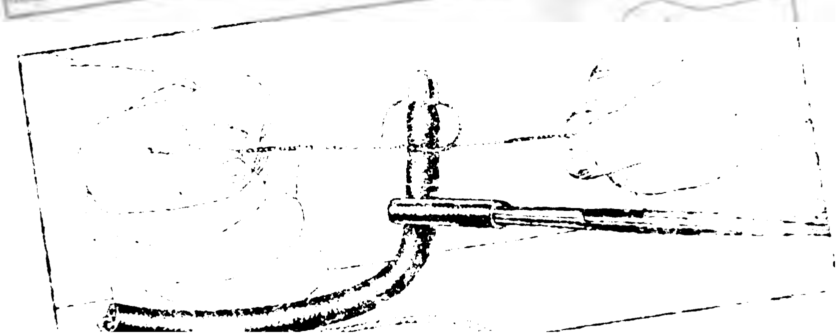


Plate No. 108-A



The end of rubber tubing may be closed by passing ends of thread through tubing about ¼ inch from end of brass screen, draw taut and tie. Trim off bulging part of tube with scissors.

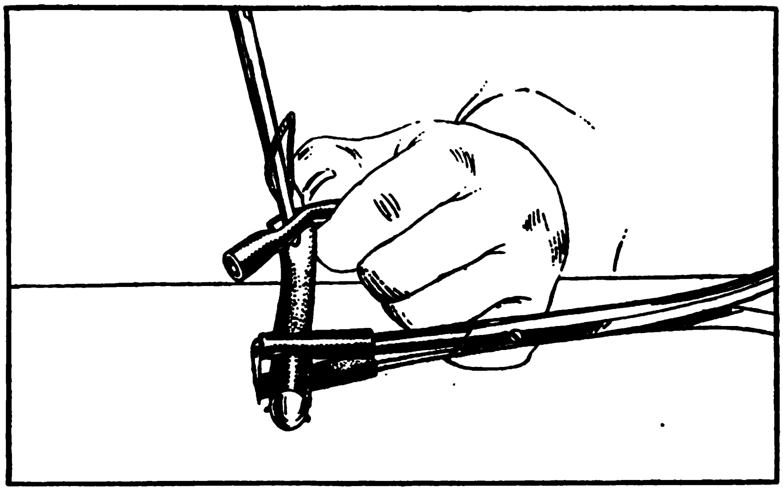


Plate No. 110

Operation No. 8

If free end of tube is to extend out of cervix or rectum, a cross-section of rubber is attached to free end to assist in holding tube in place, and, in case of the cervix, to present a larger surface against which to pack.

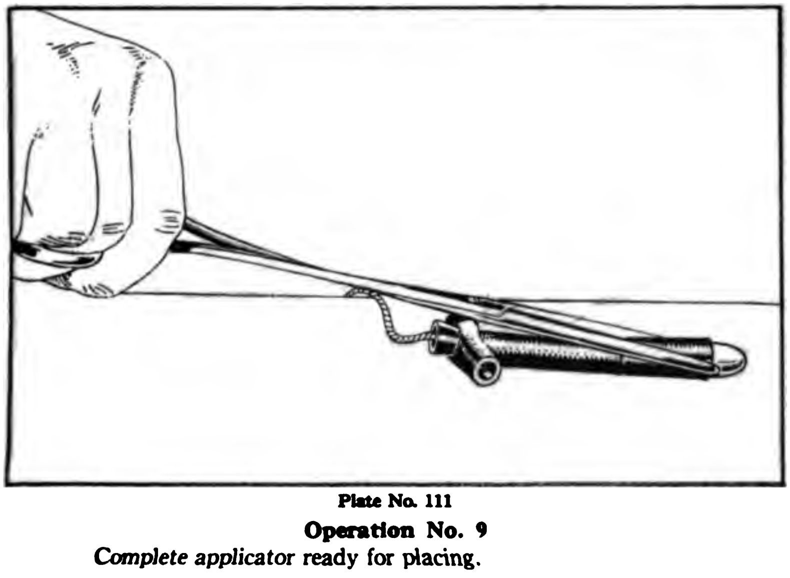


Plate No. 111

Operation No. 9

Complete applicator ready for placing.

Combined Applicator and Drainage Tube

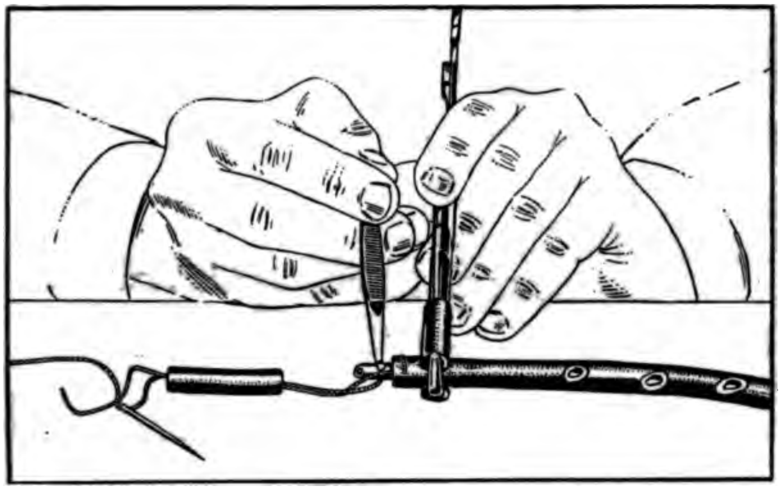


Plate No. 112

Operation No. 1

Brass screen placed in end of tube. Sutures passed as described in Plate No. 103. Radium tubes are placed. Screen held in Cameron Forceps and radium containers placed with sliding-lock forceps.

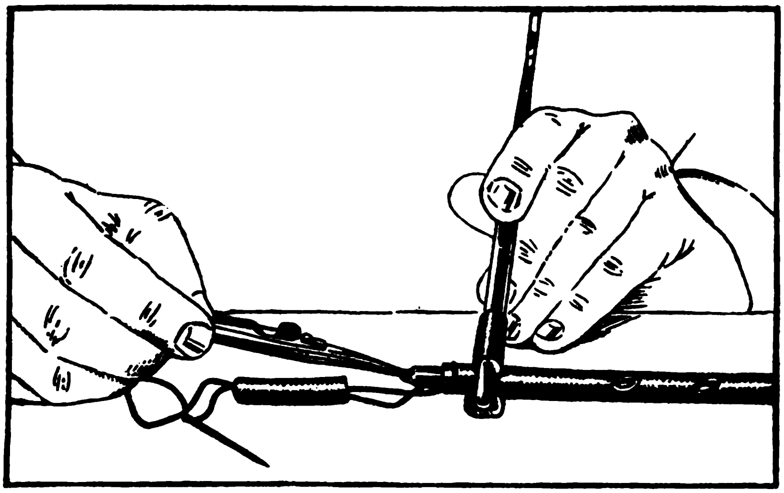
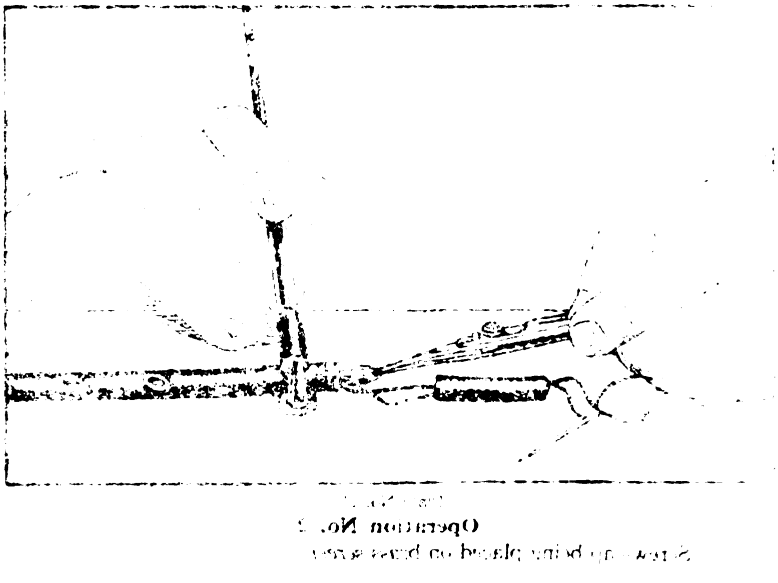


Plate No. 113

Operation No. 2

Screw-cap being placed on brass screen.



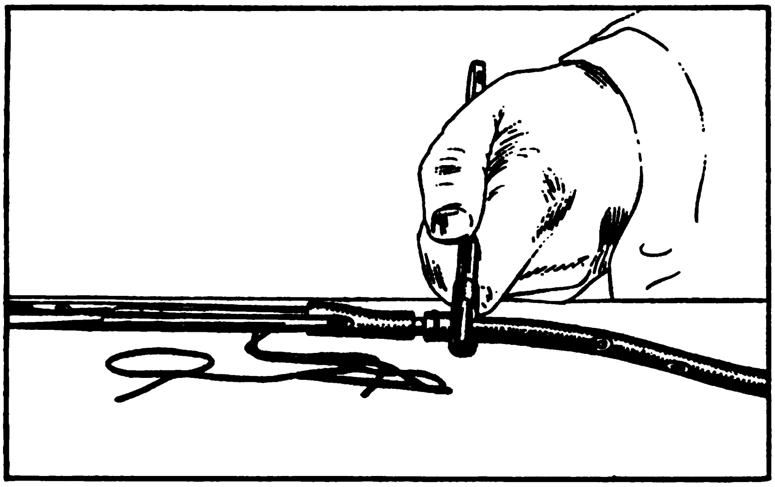


Plate No. 114

Operation No. 3

Small section of rubber being placed over exposed end of brass screen.

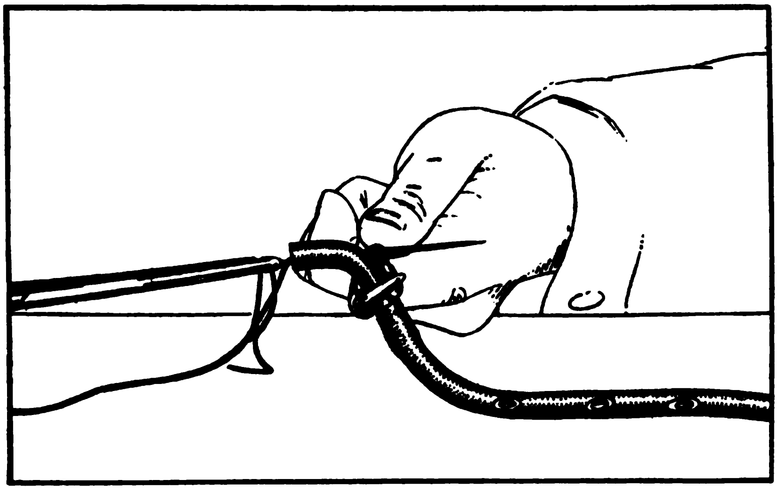


Plate No. 115

Operation No. 4

Suture passed through rubber tubing close to end of radium container.

Technique for Preparing Rubber Tubes and Needles

Combined Applicator and Drainage Tube

—*William H. Cameron, M. D.*

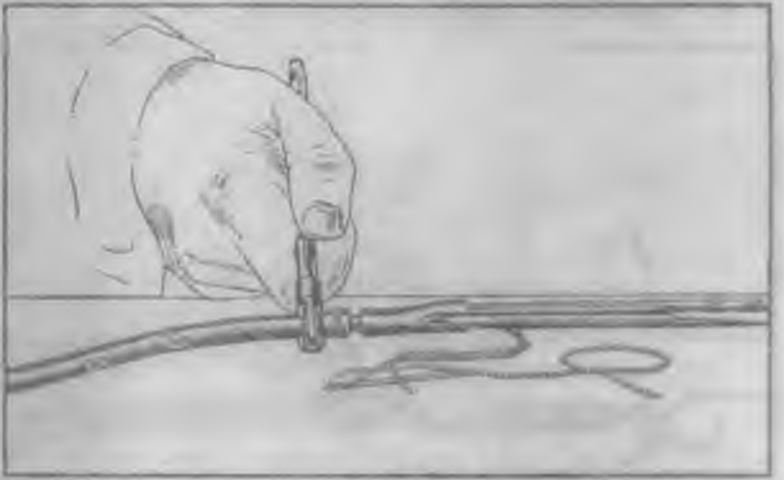


Plate No. 114

Operation No. 3

Small section of rubber being placed over exposed end of brass [illegible].

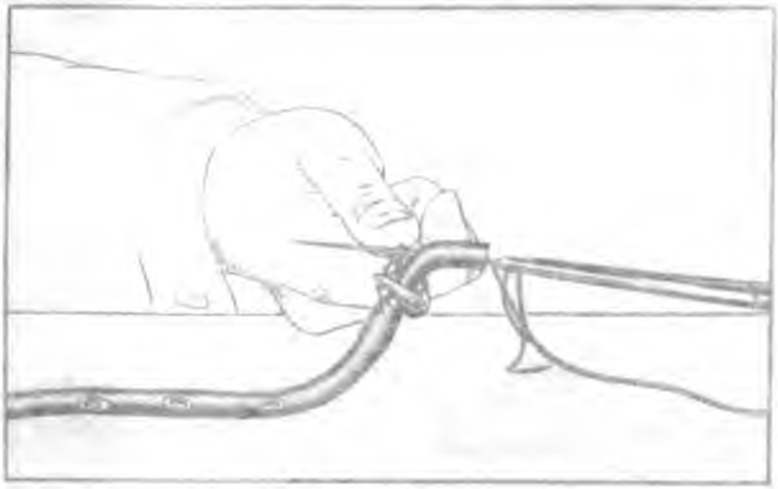


Plate No. [illegible]

Operation No. 1

Suture passed through rubber tubing [illegible] container.

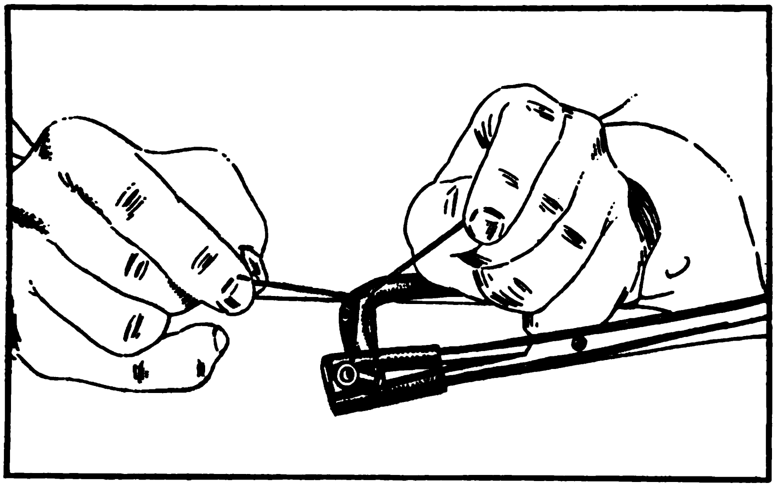


Plate No. 116

Operation No. 5

Suture being tied to prevent forward slipping of radium container.

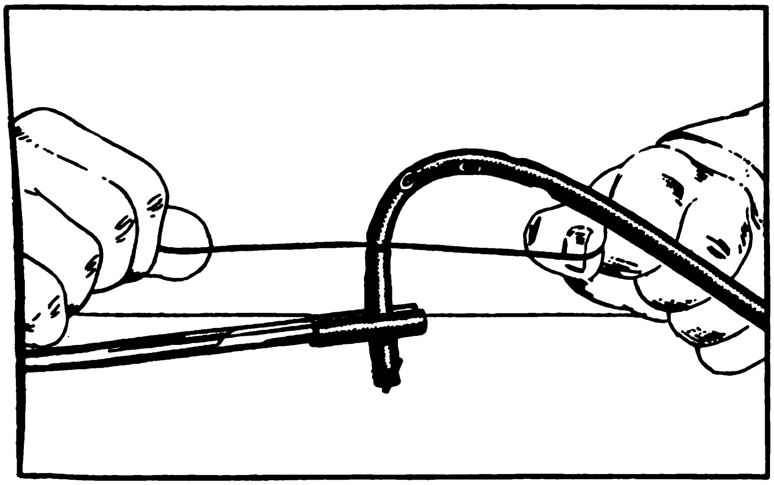


Plate No. 117

Operation No. 6

Suture being tied to prevent radium container slipping backward.

Technique for Preparing Radium Tubes and Needles

Combined Applicator and Drainage Tube

—*William H. Cameron, M. D.*

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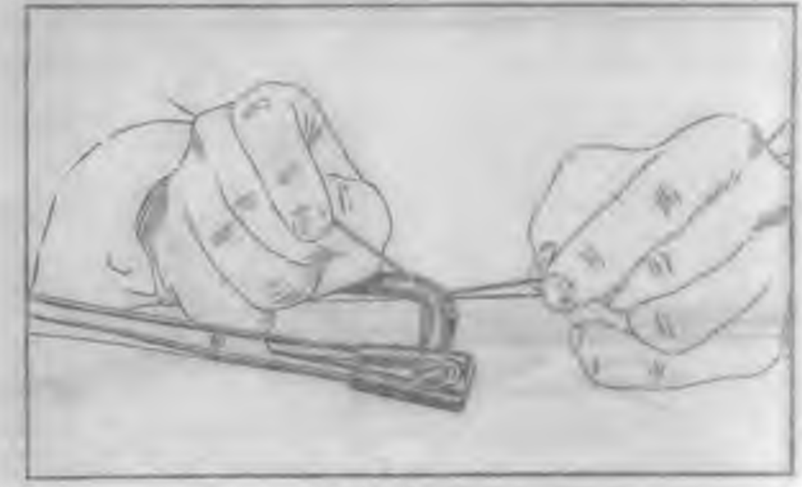


Plate No. 110

Operation No. 5

Suture being tied to prevent forward slipping [illegible]

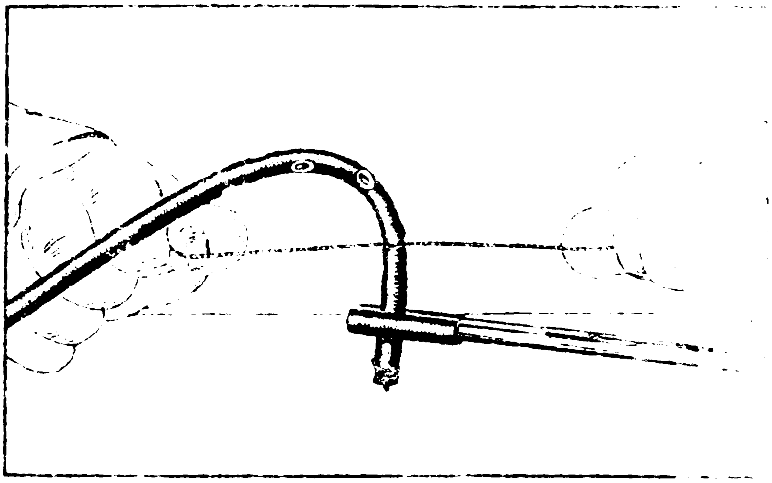


Plate No. [illegible]

Operation No. 6

Suture being tied to prevent radium container slipping back [illegible]

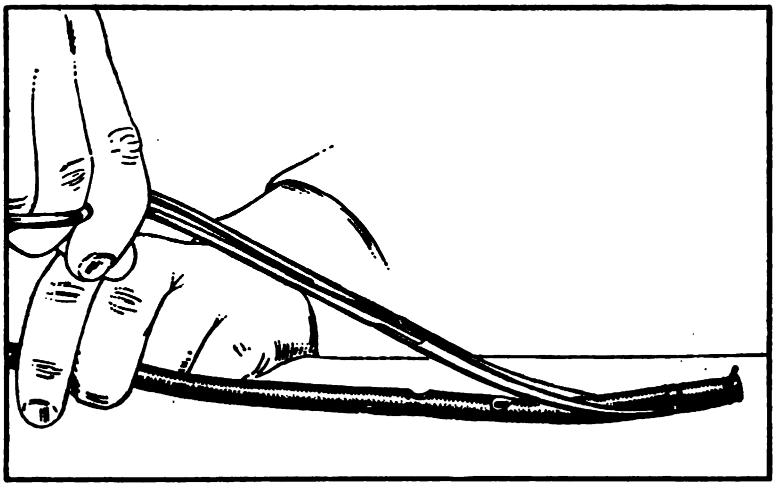


Plate No. 118

Operation No. 7

Complete applicator ready to place.

Semi-Flexible Rubber Covered Applicator

NOTE.—See Plate No. 3 for using hard rubber shell screen when possible. Here thin rubber tubing is passed over wire to the hard rubber shell.

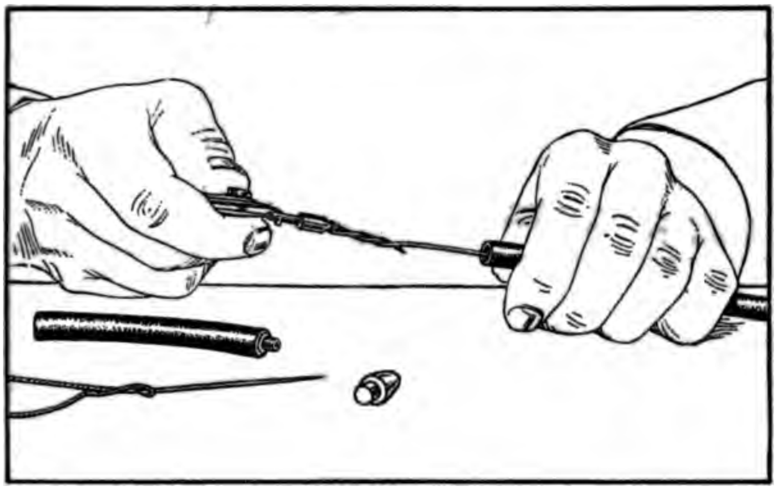


Plate No. 119

Operation No. 1

Copper, brass or silver wire of required length is selected and passed through thin rubber tubing, the lumen of which will carry the required radium tube or needles (for an individual case) and the necessary brass screen. The wire is fastened through the eyelet of the brass screen and lightly soldered. Special care must be taken that cut end of wire is not rough or sharp. Radium tube in protective capsule (or needles) is placed in screw-cap.

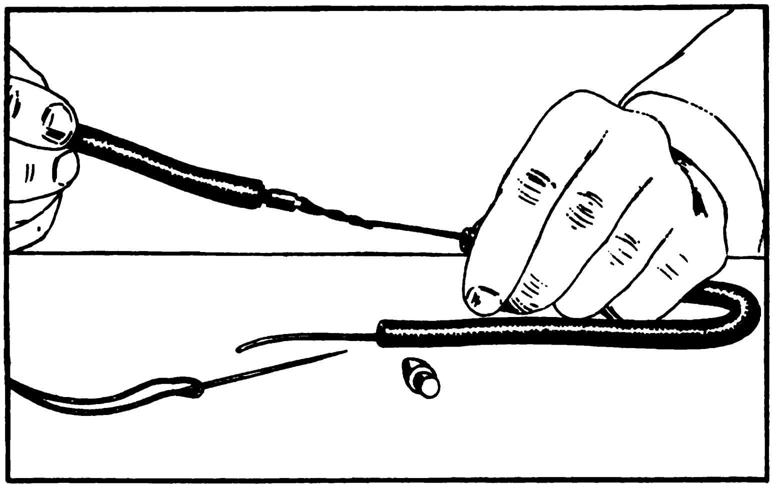


Plate No. 120

Operation No. 2

Brass screen previously placed in end of rubber tubing, being *screwed on to screw-cap.*

Semi-Flexible Rubber Covered Applicator

—*William H. Cameron, M. D.*

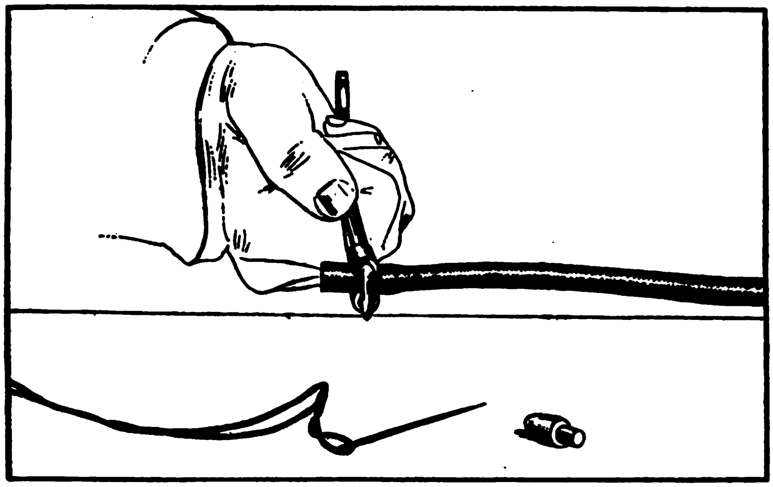


Plate No. 121

Operation No. 3

The screen is now pulled into the rubber tubing, the rubber tubing overlapping the screen about one-fourth inch.

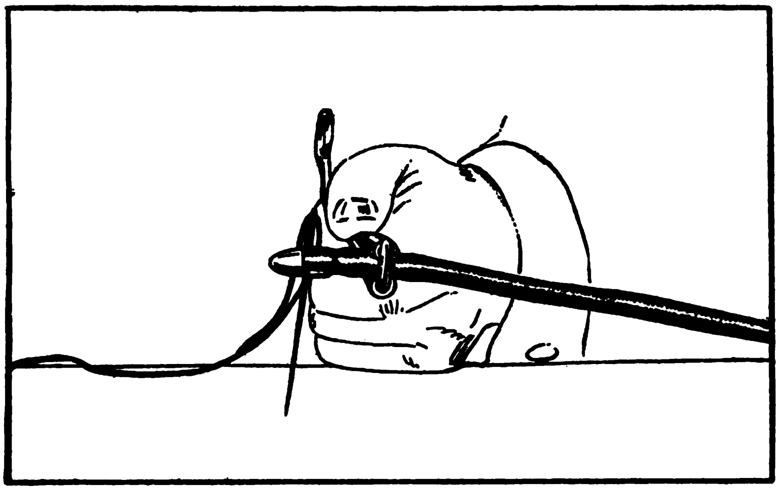
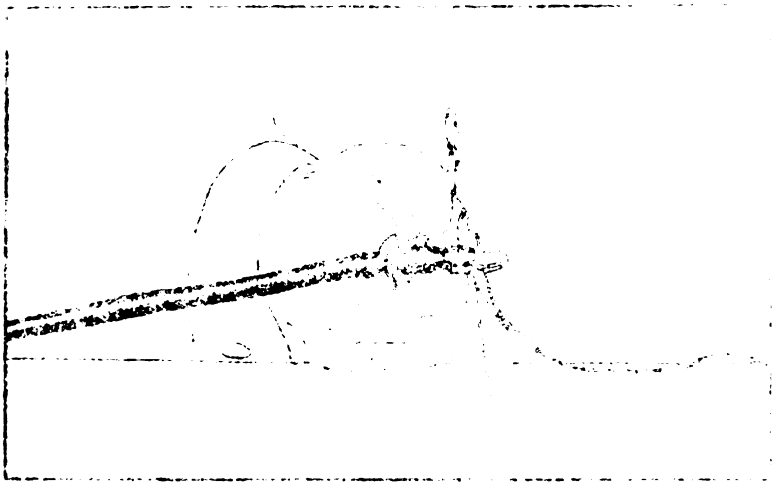


Plate No. 122

Operation No. 4

Pith wood cap is now inserted into end of rubber tubing and sutured, sutures passing through the rubber tubing and cap.



Technique for Preparing Radium Tubes and Needles

Semi-Flexible Rubber Covered Applicator

—William H. Cameron, M. D.

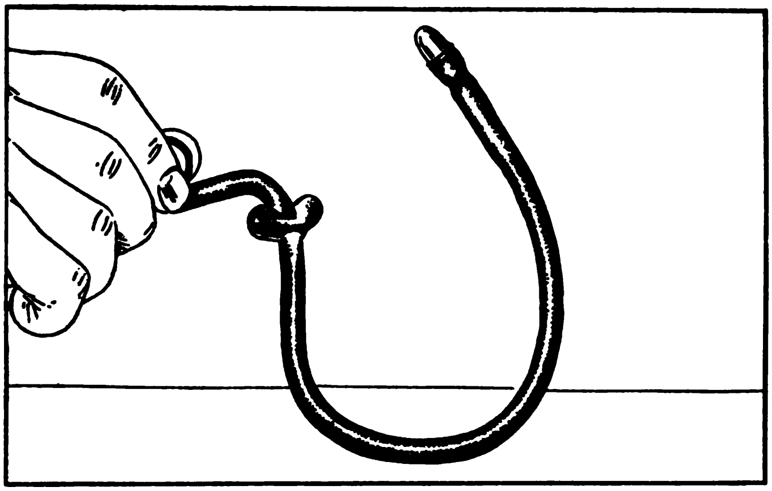


Plate No. 123

Operation No. 5

Complete applicator showing cross-piece of rubber to facilitate fastening at free end or to be caught by patient's teeth when placed in oesophagus. Bend free end of wire to form handle so that applicator will not turn when introducing.

NOTE.—As there is danger of pulling screen through rubber tubing when removing, place suture through tube and link of wire as it passes through the eyelet of the screw-cap.

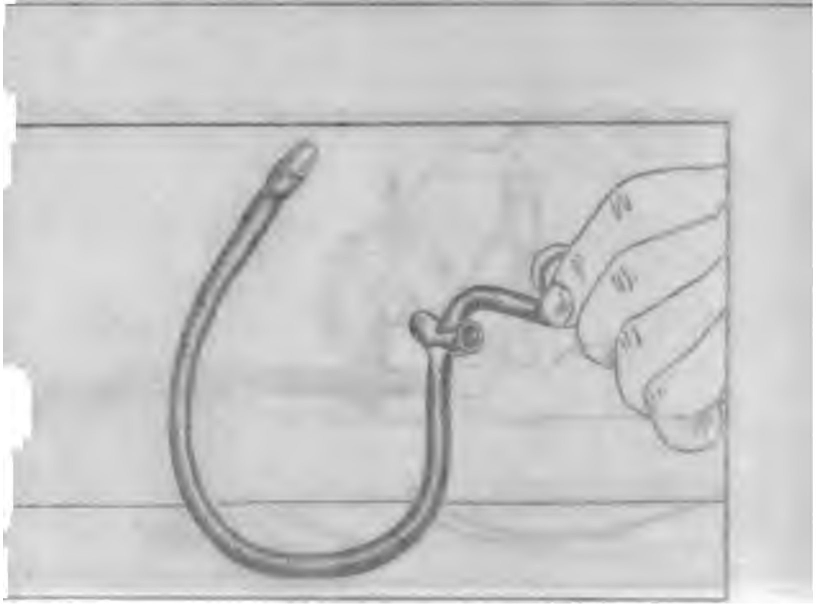
Aluminum caps to fit rubber tubing may now be had to use in place of pith wood.

It is now possible to secure rubber tubing with rounded closed end to use in place of caps when possible.

Technique for Preparing Radium Tubes and Needles

Semi-Flexible Rubber Covered Applicator

—*William H. Cameron, M. D.*



[illegible]

Operation No. 5

[illegible]

Technique for Preparing Radium Tubes and Needles. Use of Rounded Blind-End Soft Rubber Screens.

—William H. Cameron, M. D.

OPERATION NO. 1

Measure length of tube required and mark with ink at point to be cut. To secure an even edge, stretch tubing as far as possible and cut with sharp scissors.

OPERATION NO. 2.

If short length of tubing is used, thread a strong suture on large darning needle. Pass needle carrying suture in open end of tubing and plunge through blind end. Pass end of suture emerging from open end through eyelet of brass screen containing radium capsule (or through eyelet of capsule if screen is not used) and fasten securely. In securing in eyelet, be sure to leave free end of suture sufficiently long for a stitch in wall of rubber tubing (to prevent brass screen slipping backward) and to emerge from free end to form a safety string.

OPERATION NO. 3.

Grasp suture emerging from blind end with fingers and one lip of the open end of rubber tubing with forceps. Pull brass screen into lumen. If close fit, dip rubber tubing in sterile water to facilitate. If brass screen will not pass into the lumen on account of forceps grasping lip of open end, make longitudinal incisions (about one-fourth inch) in free end of rubber tubing forming a tongue like arrangement.

OPERATION NO. 4.

Cut end of suture emerging from blind end flush with rubber tubing. Grasp part of rubber tubing containing brass screen with Cameron forceps. Thread darning needle with suture emerging from free end (see last paragraph of Operation No. 2) and pass into lumen emerging through wall close up to end of brass screen. Then taking a stitch pass back through wall to lumen and again bring out through open end. This suture (if long enough) will then act as a safety string and will hold screen from slipping out of free end. If this procedure cannot be carried out pack lumen with cotton.

Note—If the length of rubber tubing prevents carrying out of the foregoing, proceed as follows:

OPERATION NO. 5.

Measure place in rubber tubing to be occupied by brass screen. About one-fourth of an inch beyond this area start an incision (use sharp pointed scissors) and carry for about one-half inch towards free end of tubing.

OPERATION NO. 6.

Thread about twelve to sixteen inches of strong thread on long darning needle or straight Yankauer needle and pass suture through incision and through blind end. The end of suture emerging from incision is passed through eye of brass screen and fastened, leaving long free end for safety string.

OPERATION NO. 7.

The brass screen (containing radium capsule) is now held in forceps and started into lumen of rubber tubing through incision. The suture emerging through blind end is grasped with fingers (suture should be long enough so that hands will not be in close contact with radium) and the free end of rubber tubing grasped with forceps. The brass screen is then pulled into place.

OPERATION NO. 8.

The brass screen in the rubber tubing is now held by the Cameron forceps. That part of the suture emerging from incision is now threaded on Yankauer needle and passed through lumen of rubber tubing, emerging at free end to act as safety string.

OPERATION NO. 9.

Close the incision by a double suture (such as cobbler uses in stitching soles) starting from the distal end of incision and working towards end of brass screen passing last stitch through tubing close to end of brass screen and fasten outside in order to decrease diameter of lumen—this to prevent brass screen from slipping backward. Cut end of suture emerging from blind end flush with tubing.

Note—In order to materially decrease diameter of lumen in rubber tubing, stretch tubing as far as possible before tying.

Technique for Preparing Radium Tubes and Needles.
Convenient Rectal Applicator.
—*William H. Cameron, M. D.*

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Part 1

NOTE.

Secure a Wales' Soft Rubber Rectal Bougie No. 8 or 11. Length as purchased 12¾ inches. May be purchased from any good surgical instrument house.

OPERATION NO. 1.

Bougie is cut off about 7 inches from flange end. Cut with sharp knife. Dip knife in water before using.

OPERATION NO. 2.

Cut end is rounded off with pair of sharp scissors and smoothed with sand paper held to a revolving emery wheel.

OPERATION NO. 3.

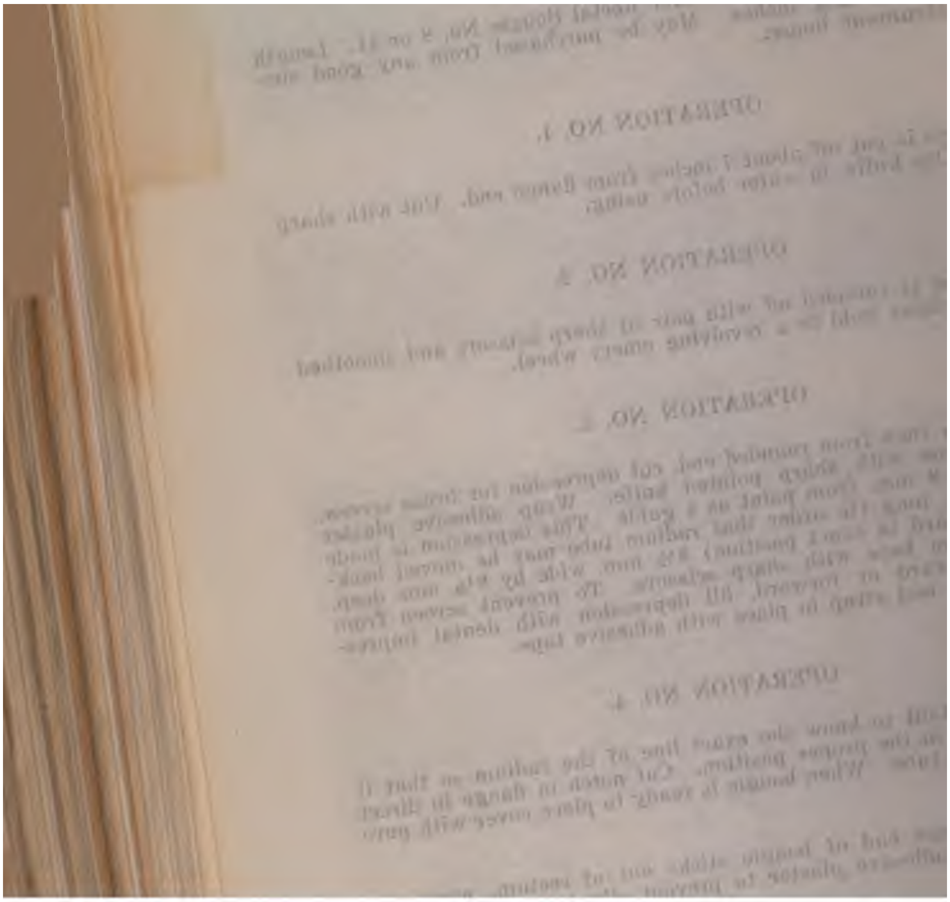
About ½ inch from rounded end, cut depression for brass screen. Make incisions with sharp pointed knife. Wrap adhesive plaster around blade 8 mm. from point as a guide. This depression is made about 50 mm. long (in order that radium tube may be moved backward or forward to exact position) 8½ mm. wide by 8½ mm. deep. Free flap from base with sharp scissors. To prevent screen from slipping backward or forward, fill depression with dental impression compound and strap in place with adhesive tape.

OPERATION NO. 4.

It is important to know the exact line of the radium so that it may be pointed in the proper position. Cut notch in flange in direct line with radium tube. When bougie is ready to place cover with pure rubber condom.

Note.—If flange end of bougie sticks out of rectum, wrap exposed part with adhesive plaster to prevent slipping backward.

To hold bougie from slipping out, use large darning needle to pass heavy suture through flange and fasten suture to patient.



Part No. IV.

Tubes and Needles Used in Surface Applications

(See Plates No. 1 and 2)

THE variety of flat applicators put forth for surface application is numerous, but, as in cavity work, the best results will, I believe, be observed when the operator studies his individual cases and adopts a form of applicator suitable for each case.

Screening to protect the skin and to differentiate between deep and superficial radiation are the paramount features of this work. When selecting a screening material the absorbing power (per millimeter) of the material should be known. For instance, 1.0 mm. of silver will "cut out" or absorb 99.9% of the hard beta rays while it will take 2.0 mm. of brass to accomplish the same purpose.

The silver protective capsule (silver being almost universally used to protect the glass radium tube) is 0.5 mm. in wall thickness, and "cuts out" 97% of the hard beta rays. The wall thickness of radium needles is 0.4 mm., and this thickness "cuts out" 87% of the hard beta rays. Some further screening is necessary then, to "cut out" all of the hard beta rays, and for this purpose 1 mm. of brass suffices. When metallic screening is used for absorption of hard beta rays, the secondary beta rays from this metallic screening must be absorbed. This is accomplished with non-metallic material, such as 1 mm. paper, or rubber, or gauze, or, according to the London Radium Institute, 0.5 mm. of aluminum.

Unless one has the applicator placed so that all parts of the radium container come in contact with diseased tissue, provision should be made to protect the healthy skin against prolonged, concentrated radiation. This may be accomplished by "distance" screening—in other words, holding the radium away from the parts to be radiated by interposing some nonmetallic substance between the skin and the radium.

It seems to me that one will or will not want to absorb the entire amount of beta rays that are escaping from the radium

applicator. Various thicknesses of metallic or non-metallic substances supposed to absorb a part of these rays are unnecessary and confusing. One thickness simplifies technique and in no way lessens efficiency. If you desire to use the beta rays escaping from the radium applicator, simply cover with thin rubber or paper. The plaques are especially devised to permit the best use of the beta rays. (Plate No. 9.) In the glass tubes, the even distribution of the rays is more difficult, and from the needles very little beta radiation is available. If the beta rays are to be "cut out," use the required amount of metallic screening, plus thin rubber or paper to absorb the secondary beta rays from the metal screen. When "distance" screening is to be used, obtain this by use of more bulky non-metallic screening. The intensity of the rays varies inversely as the square of the distance from the radium, and this factor should be remembered in estimating the distance between the radium and the parts to be affected.

The most convenient applicator I have used is one made from pith wood. This wood is lighter than cork but more durable. By sawing a series of parallel cuts on the surface opposite the radium, the wood may be made to fit any surface. It is so soft that indentations (to hold a tube or needle in place) may be made with a pencil. Holes for the same purpose may easily be drilled by a small steel drill or an ordinary darning needle. It may be cut into any shape by a pocket knife. If desired to protect from contamination, it may be covered with thin rubber. However, it is not injured by boiling.

When needles or containers are to be used in series over the surface to secure a cross-fire effect, they should be arranged at equal distances from each other and from the edge of the block.

When using pith wood, due to its slight absorbing power, the radium must always have the full, necessary metallic screening.

What I have had to say regarding the screening of tubes and needles for surface applications, applies also to the plaques. It must be remembered, however, that the radium surface of

this latter applicator emits the largest proportion of hard beta rays and additional steps must be taken to "cut out" these rays. For instance, a brass screen must be 2.0 mm. thick, a lead screen 1.0 mm. thick, etc., etc., entirely to absorb the hard beta rays.

When the beta rays are to be used, thin rubber or paper only should protect the surface. When metallic screens are used, rubber, paper, gauze, etc., must be employed to absorb the secondary beta rays set up in the metal screens.

Additional screening above the required amount, then, is a "distance effect" and any non-metallic substance may be employed. When a metal "window screen" is used, rubber or paper must be interposed between the metal and the skin surface to prevent action on normal tissue of the secondary rays from the metal of the window screen.

Buried Needles

Radium needles when buried are not screened. Consequently about 13% of the hard beta rays come into play. When threading needles, they should not be handled or held with the fingers (Plate 124), and they should only be introduced into tissues with a suitable forceps. Bees-wax (sterilized) rubbed on the end of the thread and then stripped with the finger will greatly facilitate threading. If a number of needles are being employed, the Bowen needle frame may be used not only to facilitate threading, but to hold needles in readiness for introduction.

The thread should be pushed through the eye of the needle with forceps and grasped with another forceps upon emerging from the eye. Needles may also be threaded by holding the "brass needle screen" with Cameron Forceps and placing the needle in this screen. (Plate No. 124.) This latter method is preferable, since in this way the hands are exposed only to the rays from a single needle at a time, whereas, when threading with the needles supported in the Bowen needle holder, the hands are near all of the needles. When a number of needles are employed, protection may be had by using needle holes on upright part of Operator's Protection Stand. (Plate No. 4.)

Needles when used in the 1 mm. brass screen tube, should be placed in the screen with the eye end down.

Universal needles (Plate No. 2) should not be forced into dense tissue unless a track has been made with bistoury. They may also be used, in such tissue, by passing through a specially devised trocar and canula (Plate No. 11).

The Lee Type Needle (Plate No. 10-A) presents some advantages but, as a rule, they are a little large for general work.

Technique for Preparing Radium Tubes and Needles

Buried Needles

—William H. Cameron, M. D.

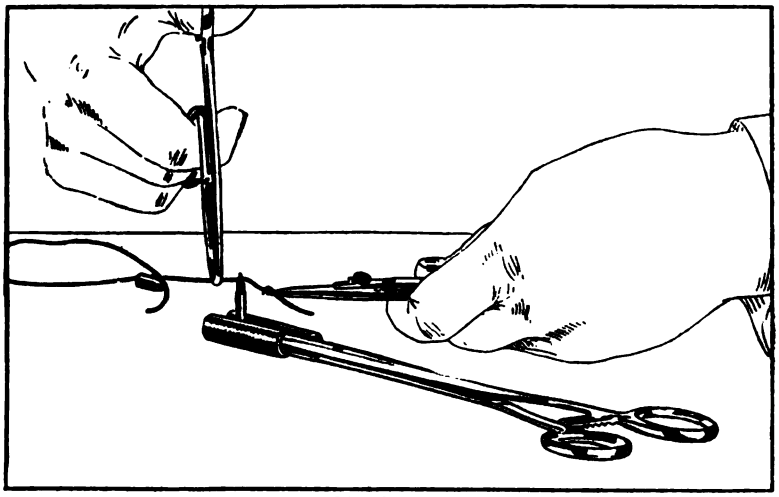


Plate No. 124

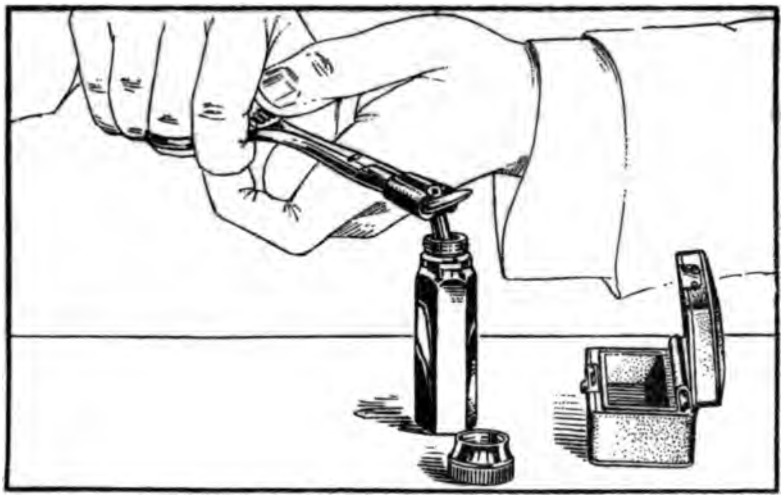


Plate No. 125

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Radium Emanation

An apparatus for drawing off radium emanation from a radium solution, purifying and securing the emanation in fine capillary glass tubes, is illustrated in Plate No. 126. This apparatus is quite complex and special instructions are required for its operation.

To be economically operated at least 500 milligrams of radium are necessary.

Radium Emanation tubes, needles and seeds are used in the same way as radium element. They have the advantage of being much smaller than the corresponding radium preparation; however, with the disadvantage of rapid decay.

For detailed descriptions of the apparatus, its operation, and the methods of employing radium emanation see:—

(1) Charles H. Viol, Ph. D., "Description of an Apparatus for the Collection, Purification and Tubing of Radium Emanation from a Radium Solution."—Radium, XIV, pp. 1-9, October 1919.

(2) William Duane, Ph. D., "Methods of Preparing and Using Radioactive Substances in the Treatment of Malignant Disease, and of Estimating Suitable Dosages."—Boston Medical and Surgical Journal, Vol. CLXXVII, No. 83, pp. 787-799, December 6th, 1917. Also reprinted in Radium, Vol. X, pp. 93-112, April 1918.

(3) G. Failla, Ph. D., "Radium Technique at the Memorial Hospital, New York."—Radium XVI, pp. 16-32, November 1920.

(4) Charles H. Viol, Ph. D., "Calculation of Dosages when Radium Emanation Is Employed."—Radium, XIV, pp. 55-58, December 1919.

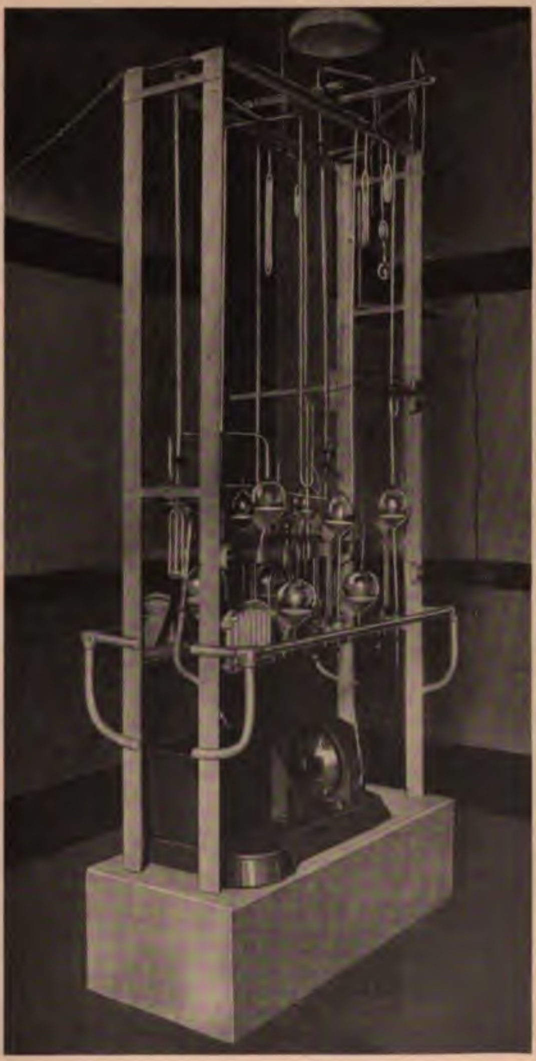

Plate No. 126

Glossary of Terms in Radioactivity and Radiumtherapy

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GLOSSARY OF TERMS IN RADIOACTIVITY AND RADIUMTHERAPY

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ABSORPTION OF RAYS: The absorption of alpha rays is an atomic property of the absorbing substance, proportional to the square root of the atomic weight, if elementary, or to the sum of the square roots of the constituent atoms, if a compound or mixture. It does not follow a simple exponential law, the exact law being unknown. All alpha rays are easily absorbed, 3 to 8 cm. of air (depending on the range) or 0.01 to 0.03 mm. thickness of aluminum being sufficient to completely absorb them. For homogeneous beta and gamma rays the absorption takes place in accordance with a simple exponential law. Since, however, the beta and gamma rays from radium are not homogeneous, due to their various velocities in the case of beta, and their different wave lengths in the case of gamma rays, the actual absorption of these rays is a quite complicated function.

ABSORPTION OF BETA RAYS: A consideration of the absorption of a particular type of beta rays with increasing thickness of metal will suffice to exemplify in a general way the absorption of the beta and also the gamma rays. It has been found, for example, that about 0.1 mm. of silver suffices to absorb fifty per cent of the hard (most penetrating) beta rays emitted from a radium tube, these particular rays being due to a transmutation of the product Ra C. The use of 0.2 mm. of silver, however, does not effect a complete absorption of these hard beta rays, the additional 0.1 mm. of metal merely serving to absorb fifty per cent of the rays that passed through the first 0.1 mm. of silver.

In the following table the first column gives the thickness of the silver screen in millimeters, and the second column shows the per cent of the hard beta rays absorbed in the corresponding thickness of silver:

TABLE I

Thickness of Silver Screen in Millimeters	Per Cent of Beta Rays Absorbed by Screen
0.1	50.0
0.2	75.0
0.3	87.5
0.4	93.7
0.5	96.8
0.6	98.4
0.7	99.2
0.8	99.6
0.9	99.8
1.0	99.9

A study of this Table I shows, for example, that 0.5 mm. of silver suffices to absorb nearly ninety-seven per cent of the hard beta rays, and if the thickness of the screen be doubled the additional metal is used merely to absorb the remaining three per cent of the rays.

A general rule, which holds with sufficient accuracy for all purposes, is that the absorbing power of metals for a given type of beta or gamma radiation increases in proportion to the density of the metals. Thus aluminum, with a density of 2.7, which is about one-fourth as dense as silver (10.6), will, in accordance with the rule given above, need to be used in four times the thickness of silver to absorb a given type of rays to the same extent. In Table II are given the density, half-absorption thickness, and the thickness of various materials required to absorb 99.9% of the hard beta rays from Ra C:

TABLE II—Density and Screening Power of Various Materials

Ray Absorbing Material	Approximate Density	Thickness of absorbing material required to absorb 50 per cent of the hard beta rays of radium	Thickness of absorbing material required to absorb 99.9 per cent of the hard beta rays of radium
Water	1.0	1.00 mm.	10.00 mm.
Gum rubber	1.0	1.00 mm.	10.00 mm.
Soft tissues	1.0	1.00 mm.	10.00 mm.
Bone	1.7-2.0	0.60 mm.	6.00 mm.
Glass (common)	2.6	0.40 mm.	4.00 mm.
Aluminum	2.7	0.40 mm.	4.00 mm.
Steel	7.7	0.14 mm.	1.40 mm.
Brass	8.5	0.13 mm.	1.30 mm.
Nickel	8.7	0.13 mm.	1.30 mm.
Copper	8.9	0.13 mm.	1.30 mm.
Silver	10.6	0.10 mm.	1.00 mm.
Lead	11.3	0.10 mm.	1.00 mm.
Gold	19.3	0.06 mm.	0.60 mm.
Platinum	21.5	0.05 mm.	0.50 mm.

ABSORPTION OF GAMMA RAYS: The hard gamma rays of radium are far more penetrating than the hard beta rays, requiring, for example, 13 mm. of lead for their half absorption as compared with 0.1 mm. lead required to absorb half of the hard beta rays. Consequently, to absorb 99.9 per cent of the hard gamma rays, requires ten times this thickness of lead (cf. Table I, where it is seen that ten times the half-absorbing thickness of metal absorbs 99.9 per cent of the rays) or thirteen centimeters of lead (five and one-eighth inches).

ABSORPTION COEFFICIENT: Beta rays when homogeneous, are absorbed according to the following simple exponential law:

$I^t/I^o = e^{ut}$; I^o and I^t are the intensities of the rays initially and after passage through a thickness of matter t, u being the coefficient of absorption and e a constant, the base of the natural logarithms, having a value 2.71828. If t^1 is the thickness of the absorbing layer in centimeters that reduces the intensity to half value, $t^1 = 0.693/u$. For beta rays from radium the value of u for aluminum is 200 cm., so that t^1 is $0.693/200 = 0.00346$ cm. of aluminum to reduce the intensity of the rays one half. Gamma rays follow the same exponential law, the average value of u for the gamma rays of radium being 0.50. From this $t^1 = 0.693/0.5 = 1.38$ cm. of lead to absorb half of these rays.

ACTINIUM AND ACTINIUM SERIES: Actinium is a radio-element associated with uranium in pitchblende. The actinium series of disintegration products is supposedly a branch series of the uranium, being formed from U Y which represents about 3% of U_2. Actinium itself emits very slow beta rays and little is known concerning it. The later members of the actinium series have very short life periods. The actinium series embraces the elements as shown in the following table:

ACTINIUM FAMILY

(1) Name	(2) Atomic Weight	(3) Half Decay Period	(4) Radiation
3% of Uranium II...	234	About 1,000,000 years	Alpha
Uranium Y..........	230	1.5 days	Beta
Protactinium	230	Estimated 1,200 to 180,000 yrs.	Alpha
Actinium	226	About 30 years	Soft Beta
Radio-actinium	226	19.5 days	Alpha
Actinium X	222	11.4 days	Alpha
Actinium Emanation.	218	3.9 seconds	Alpha
Actinium A..........	214	0.002 seconds	Alpha
Actinium B	210	36.1 minutes	Beta gamma
Actinium C	210	2.15 minutes	Alpha
Actinium D	206	4.71 minutes	Beta gamma
End Product	206	....	....

ACTIVE DEPOSIT: Name given to the non-volatile disintegration products of the emanations. Active deposits of *rapid* change consist of the A products and its successors which are relatively short-lived. RaA, RaB, RaC_1 and RaC_2 of the radium senes constitute the active deposit of rapid change, while the members following, (see radium series) make up the active deposit of slow decay. The active deposit is conveniently collected upon a negatively charged plate exposed to the emanation. Other names for active deposit are "excited activity" and "induced activity."

By exposing metal foils or sodium chloride crystals for four hours to the action of a high concentration of radium emanation very active preparations of the active deposit may be secured for use as local applicators, or after solution of the salt in sterile

water, for injection. Such preparations of active deposit are standardized by comparing their gamma ray activity with that of a standard radium prepration.

ACTIVITY: Most of the older radium preparations were sold on the basis of an "activity" expressed in terms of the alpha ray activity of uranium metal as unity. This gave large numbers since pure radium bromide was set as 2,000,000 times as active as uranium metal. Half pure radium bromide was said to be of 1,000,000 activity. Unfortunately when such preparations are now compared with radium standards, comparisons being made by means of the gamma rays, it is found in most cases that the radium element content is far below that which is expected. The standardization of all radium preparations on the basis of the International Radium Standard is now the accepted practice, and all preparations should be purchased *only on the guarantee by responsible dealers of the content of radioactive element in terms of this standard* or with certificates from the Bureau of Standards. The description of preparations in terms of their radium element content is the best practice since the therapeutic value is dependent on the radium element content. (See Measurement of Radium).

AGING OR MATURING OF RADIUM: Since radium preparations owe their gamma ray activity to the presence of RaB and RaC, it is necessary that these products accumulate in maximum amount before the standardization of the radium is undertaken. The period for the accumulation of the equilibrium amounts of RaB and RaC is dependent upon the slower rate of accumulation of radium emanation. Thirty days from the time of hermetically sealing a radium preparation, initially free from radium emanation, allows the accumulation of 99.5 per cent of the equilibrium quantity of radium emanation (q. v.) and this period of a month is therefore required for the aging or maturing of newly made radium applicators. (See Equilibrium).

ALPHA RAYS: (See Atom.) One of the types of radiation from radioactive substances, consisting of the nucleus of the helium atom (which is the atom minus its two outer negative electrons) expelled from the nucleus of the radio atom with a velocity about one-twentieth that of light, and bearing a charge twice that of hydrogen atom in electrolysis (or 9.3×10^{-10} electrostatic units) : (0.00000000093). In their passage through matter the rays cause ionization and thus render air conductive of electricity, and so discharge electroscopes. They also affect a photographic plate, and produce scintillations in certain substances, e. g. phosphorescent zinc sulfide. The rays are slightly deviated in a strong magnetic field at right angles to their path. The alpha rays from different radioactive substances have different velocities of expulsion and ionize the air for different distances referred to as the "range." The number of ions per

cm. of path varies, increasing rapidly to a maximum within a few mm. of the end of the range. One alpha particle from Ra C, initial velocity, 2.06 x 10^9 (2,060,000,000) cm. per sec., produces 2.37 x 10^5 (237,000) ions. Its energy is 1.31 x 10—^{5} ergs. See also range, scattering, absorption, transformation. Owing to the ready absorption of the alpha rays (a sheet of thin paper suffices for their complete absorption), they can produce only the most superficial effects on tissues, and in practice play no part in the local application of radium. When radium and radioactive substances are used internally, no doubt the main effects are due to the action of alpha rays which carry by far the greater portion of energy liberated in the transformation of the radio elements. The alpha rays from a gram of radium in equilibrium with Ra Em, Ra A, Ra B, Ra C, produce 123 of the 136 calories of heat produced by all the rays in an hour.

APPLICATORS. Applicators are instruments for the use of radium and other radioactive substances in the local application of the rays for therapeutic purposes. In the case of radium three types of applicators commonly used are (1) tubes, (2) needles, (3) glazed surface plaques.

In the tube applicators, radium sulfate is sealed hermetically in thin-walled glass tubes, of such dimentions as not to permit any considerable motion of the salt in the tube. In practice such tubes are almost always used in a thin-walled metal container, such as a silver capsule of 0.5 mm. wall thickness, any additional filters being placed over the silver capsule. Such tubes usually contain 25, 50 or 100 mg. of radium element.

Needles of non-corrosive alloys or platinum have the radium sulfate filled directly into the hollow shaft o fthe needle which is then hermetically sealed by soldering in a screw cap. Needles are very convenient for insertion directly into sumor masses. Radium needles are usually made containing 5, 10 or 12.5 mg. of radium element. Where radium emanation is available in tiny glass tubes these are frequently inserted into tissues by the use of a special hypodermic needle.

Glazed surface plaques* are now widely used, having replaced the older varnish applicators, which were found unsatisfactory owing to their very short life. These plaques are made by fusing on a suitable metal back, a glaze which contains the radium sulfate in uniform distribution. Such plaques can be sterilized by the various chemical agents such as phenol, formalin, alcohol, etc., and have proven very durable. The *strength* of plaques is usually expressed in terms of the radium element present per square centimeter of area. Full strength plaques contain 5 mg. of radium per sq. cm.; half strength, 2.5 mg. per sq. cm.; quarter strength 1.25 mg. per sq. cm. Thus a

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*U. S. Patent No. 1210731, Jan. 2, 1917, assigned Standard Chemical Co.

plaque of 2 x 2 cm. dimensions, with 10 mg. of radium contains 2.5 mg. per sq. cm. and so is described as a 10 mg. half strength surface applicator. Surface applicators find their greater use in the treatment of the many superficial skin lesions which are amenable to the radium rays. Toile applicators are rubberized cloths impregnated with small amounts of radium. They are very short lived and usually are not made to exceed one-twentieth strength.

ATOM. The present conception of the atom makes this small particle very complex, somewhat resembling a small solar system. The atoms are conceived to be made up of negative and positive electrons, the mass of the negative electrons being very small, $\frac{1}{1700}$ that of a hydrogen atom, while the mass of the positive electron is practically that of the hydrogen atom, which is supposed to consist of but a single positive electron around which revolves its single negative electron. In the more complex atoms of higher atomic weight, the nucleus or central "sun" contains all of the positive electrons which determine the mass of the atom, together with a fewer number of negative electrons. This results in an excess of positive electrification in the nucleus, which is just offset by a sufficient number of negative electrons which revolve in orbital rings at relatively great distances from the nucleus. Helium with an atomic weight of 4 has a nucleus composed of 4 positive and 2 negative electrons, and 2 negative electrons rotate about this nucleus. The alpha ray is a helium nucleus, the beta ray a negative electron, it will be recalled, and these rays are shot out at high velocity from the nucleus of the radio atom. The number of these outer negative electrons determines the chemical and spectroscopic properties of the atom, and atoms of different atomic weights (i. e., nuclei of different make-up) which have the same number of negative electrons in their outer rings are chemically and spectroscopically identical, and are called *isotopes*. This can be shown in the decay of uranium 1 to uranium 2, as follows:

Uranium 1		loss of alpha ray
	238-|-electrons	4-|-electrons
92—electrons	146—electrons	2—electrons
outer rings	nucleus	helium nucleus
Uranium X^1		loss beta ray
	234-|-electrons	
90—electrons	144—electrons	1—electron
outer rings	nucleus	
Uranium X^2		loss beta ray
	234-|-electrons	
91—electrons	143—electrons	1—electron
outer rings	nucleus	
Uranium 2	234-|-electrons	
92—electrons	142-|-electrons	

Remembering that the number of negative electrons in the outer rings can adjust itself so that the atom is electrically neutral, it will be seen that the loss of an alpha ray and two beta rays in passing from U_1 to U_2 leaves U_2 with the same number of negative electrons in the outer rings as U_1, and consequently these elements are isotopic—i. e. chemically and spectroscopically identical. It has been found that the loss of an alpha ray leaves a new radio atom whose valance is less by two than the parent element, while the loss of a beta ray results in an increase in valance of one. Thus in the series shown, U_1 has a valance of 6, U X_1, 4, U X_2, 5, and U_2, 6.

Uranium$_2$, upon loss of an alpha ray leaves ionium with a valance of 4, and this element after loss of an alpha ray leaves bivalent radium, which in turn loses an alpha ray and leaves zerovalent radium emanation. When radium emanation loses an alpha ray, the resultant atom is in the next cycle of the periodic groups and Ra A has a valance of 6. Ra A on loss of an alpha ray produces quadrivalent Ra B, isotopic with lead, etc.

BEQUEREL RAYS A term formerly used to describe the rays emitted from the radioactive substances.

BETA RAYS. (See Atom.) The beta rays are negative electrons shot out from the nucleus of the transmuting radio atom with a velocity which in some cases is nearly that of light, 186,000 miles per second. The velocity of the beta rays from Ra C is 96% that of light. Beta rays are more penetrating than alpha rays, the swifter or harder beta rays from radium being half absorbed in about 1 mm. of soft tissue or 0.1 mm. of lead or silver. The next equal thickness of these materials will then absorb 50% of the remaining rays, etc., so that 10 mm. of tissue or 1 mm. of lead or silver absorbs 99.9% of these hard beta rays. (See Absorption.) The beta rays from Ra B and Ra C, in equilibrium with a gram of radium element, produce per hour 4.3 calories of heat. A bundle of parallel beta rays will be deflected from its path by passing through a strong electro-magnetic or electrostatic field, due to the negative charge, and observation of this deflection in fields of known strength serves to measure the velocity of the beta rays, since the faster the electron travels, the less the deviation in a field of given strength. The beta rays are closely related to the gamma rays. (See Gamma Rays.)

BLANK OR AIR LEAK. The discharge of the charged leaf system of an electroscope due to natural or other ionization when no radioactive substance is near the instrument. This is important and must be taken into account in all quantitative electroscopic or electrometric measurements. (See Ionization.)

CANAL RAYS. These are the X-ray tube analogues of the alpha rays, and were discovered by Goldstein by the use of a perforated cathode. They consist of positively charged atoms (atoms lacking some of the outer ring negative electrons, see *atom*) and move back from the cathode in a direction opposite to that of the cathode stream of negative electrons. By studies of the deflection of these rays in an electric field, their atomic mass can be determined and in this way Aston has shown that a number of the elements are not homogeneous, but consist of a mixture of isotopes, as, for example, neon and chlorine.

CARNOTITE. A uranium ore consisting essentially of a potassium or calcium uranyl vanadate. This material occurs in a number of places, but its principal deposits which serve as the world's largest source of radium are in southwestern Colorado and southeastern Utah. These deposits were discovered in 1899 by Poulot & Voilleque, two French prospectors, who were attracted by the bright sulfur yellow color of the material, samples of which they sent to Friedel and Cumenge in France, who analyzed the substance and named it carnotite. Carnotite ore is a low grade ore, and consists usually of a sandstone cemented by the carnotite material. It is geologically an old ore and so contains the equilibrium amount of ionium (3,000,000 grams of uranium per gram of radium). Small amounts of the high grade cornotite were shipped to France, England and Germany after 1910, to serve as a source of radium and vanadium but it was through the pioneer work of Joseph M. Flannery, of Pittsburgh, founder of the Standard Chemical Company, that radium was first produced in the U. S. from carnotite, and as a result of his work, the lower grade carnotite ore is now concentrated and made the source of the largest parts of the world's radium output. Roughly speaking 500 tons of carnotite milling ore will yield 125 tons of concentrate averaging about 4% U_3O_8 and from this a gram of radium element can be obtained by the use of about 500 tons of chemicals and 1000 tons of coal, etc. Regarding the freedom of radium prepared from carnotite from other radioactive products, see under Measurement of Radium.

CATHODE RAYS. These are the negative electrons which pass from the cathode to the anode in an evacuated tube through which is passed a high potential current. Cathode rays differ from beta rays only in having a lower velocity. Due to their lower velocity the cathode rays are very easily absorbed, and it was only by using a window of very thin aluminum that Lenard was able to work with these rays outside of the vacuum tube. In the X-ray tube it is the impinging of the cathode ray stream on the anti-cathode that sets up the X-rays.

CENTIGRAM. One-hundredth of a gram.

CONDUCTIVITY OF GASES. Gases are not conductors of the electric current unless by some means they are ionized (see ionization). When subjected to heat or the rays of the radio-

active substances, X-rays, etc., the molecules lose negative electrons, being thereby left with a positive charge. These electrons and positively charged molecules then are capable of being influenced by an electric potential, their motion under the potential giving rise to the ionization current. Due to this current, the charge on the leaf system of an electroscope passes to the case of the instrument, and as the charge is lost, the potential falls and this results in the fall of the leaf which is held at an angle to the leaf support by electrostatic repulsion (see electrometer).

CROSSFIRE. See Technic.

CURIE. The curie by adoption of the International Congress of Electrology and Radiology Meeting in 1910 at Brussels is defined as the quantity of radium emanation in equilibrium with one gram of radium element. Its volume at O°C. and 760 mm. Hg. pressure is 0.6 cu. mm. and a curie of emanation weighs 6 micrograms (0.000006 gm.) By definition it follows that the curie has the same gamma ray activity as a gram of radium, and radium emanation preparations, because of their rapid decay (See Ra Em) are always calibrated by the use of a radium standard. Corresponding to the submultiplies of the gram there are milli- and micro-curies.

DECAY CONSTANT. See radioactive Constant.

DISCHARGE OF ELECTROSTOPE. See Conductivity of Cases and Electrometer.

DISINTEGRATION. See Radioactive Transformation.

DISTANCE as Effecting Intensity of Radiations. See Technic.

DOSAGE. In expressing dosage when applying radium rays, a number of factors must be considered if the data are to be of any value. The quantity of radium or radium emanation employed should be stated and with this the screening, if any, the distance of the radioactive material from the growth and the distribution of the radioactive material over the surface of the growth, and the time of application of the radium. Where a method of application is fairly well standardized, dosage can often be conveniently expressed in terms of the product of milligrams of radium or millicuries used and the number of hours it is applied, the product, being the so-called milligram or millicurie hours. Thus 100 mg. of radium applied for 50 hours gives a dosage of 5,000 mg. hours. Obviously 10 mg. for 500 hours is also 5,000 mg. hours, but the same physiological reaction would not result from such a dose as from the same number of mg. hours using 100 mg., since the interval in which the dose of radiation has cumulative action (week to 10 days for gamma rays) cannot be greatly exceeded if similar results are to be attained. The maximum ray dose which the

normal skin will bear without too severe a reaction which would result in a destruction of the skin is called the skin erythema dose. This limits the amount of radiation that can be fired through a given skin area into an underlying growth, and it is to avoid too intense skin reactions that the device of spreading the radium over a considerable area (plaque effect) is adopted. The lethal dose for the cells of various pathological growths varies, being small in some, such as the non-malignant vascular growths, warts, nevi, angiomata, etc., and very large for some of the malignant tumors such as squamous celled carcinomata and melanotic sarcomata.

ELECTROMETER. Any instrument serving to measure quantitatively the ionization currents. Two general types are employed, the so-called leaf electrometers, and the quadrant or binant type of electrometers. The first type consists essentially of a thin flexible leaf of metal foil—aluminum, silver or gold—mounted by its upper end to an insulated vertical metal rod or support. The leaf system is usually housed in a suitable metal case with windows which permit observing the leaf motion and with a suitable charging device to permit placing an electrostatic charge on the leaf system. When charged, the electrostatic repulsion between the charge on the leaf itself and on the leaf support results in the leaf moving out at an angle to the support like an inverted V, the angle being nearer a right angle the greater the potential of the charge. When the gas surrounding the leaf system is ionized as by the action of the radioactive substances, the leaf charge gradually is conducted away on the gas ions and as the potential falls, the leaf moves back towards a vertical position. Over short parts of its path the leaf moves more or less uniformly at a rate proportional to the ionization of the gas and so when the motion of the leaf is observed through a suitable reading microscope provided with cross hairs or a divided scale in the ocular, quantitative observations of the ionization current can be made, and since the ionization of gases is proportional to the quantities of radioactive substance, under suitable conditions, the electrometer when properly calibrated or checked with proper radioactive standards serves as a quantitative measuring instrument for the amount of radioactive substance. When the electroscope is provided with a suitable gas-tight ionization chamber with stop-cocks to admit radium emanation, the electrometer is called an emanation electrometer. Since radium emanation is the direct decay product from radium, its presence indicates the presence of radium, and it is by separating the radium emanation from such things as minerals, ores and other solid materials and estimating the amount of radium emanation in an emanation electrometer, that it is possible to determine the radium content of these substances. It was in this way that we have learned that the ordinary soils and rocks contain about a millionth of a millionth part (10^{-12})

of radium, and the sea water about one thousandth part of what rocks contain. When a heavy walled electrometer is used which only permits the passage of gamma rays into the ionization chamber, it is called a gamma ray electrometer. (See Measurement of Radium and Standards).

The binant and quadrant types of electrometer are less readily handled by one not specially trained, and for their description and use the reader is referred to standard text books on physics.

ELECTRON. The smallest particle of negative electricity is called a negative electron. It has an electro-magnetic mass equal to $\frac{1}{1700}$ the mass of the hydrogen atom, the lightest of the known elements. The electric charge represented by the negative electron is the unit of electricity and has been determined as a result of many careful researches to be equal to 4.7×10^{-10} electro-static units. Present atomic theory (See Atom) makes the hydrogen nucleus the positive atom, and its greater mass (practically I in terms of the H atom) is accounted for in the electromagnetic theory of matter, by making its diameter $\frac{1}{1700}$ 9 the diameter of the negative electron. According to the present theory, all matter is composed of positive and negative electrons.

ELECTROSCOPE. See Electrometer.

EMANATION. See Radium Emanation, Thorium Emanation, Actinium Emanation. Owens in 1899 showed that the inconstancy of the radioactivity of thorium oxide was due to air currents, and further that a thorium oxide preparation through which an air current was blown gave a minimum activity. Rutherford found this result was due to the emission of radioactive particles which he called emanation. Emanation had the properties of ionizing gases, acting on photographic plates, and being able to diffuse through porous material, and experiments showed it could not be a radioactive dust, but must be of a radioactive gas. The term "emanation" is still unfortunately used by many as synonomous with radiations. The emanations are not radiations, but are radioactive gases, which are just as real as oxygen or hydrogen, differing in having an unstable nucleus, which results in their atoms undergoing a radioactive transformation. The decay products from the emanation are called active deposit. See Active Deposit.

Radium emanation which is the longest lived of the three known emanations, with a half decay period of 3.85 days, is of considerable importance in therapeutic application of radium.

EMANATORIUM. A room where patients come to inhale air charged with radium emanation. This form of treatment was

first suggested in arthritis, gout, etc., by the fact that the waters of many of the celebrated spas are slightly radioactive with radium emanation, and it was expected that the results of emanation inhaled in the emanatorium would be equally effective as drinking the waters. This treatment has been largely abandoned, and is replaced by the intraveneous injection of radioactive solutions of radium, radium emanation or radioactive deposit, or the ingestion of water charged with radium emanation or actual radium salt, per os.

EQUILIBRIUM OF RADIOACTIVE SUBSTANCES. When the primary source (uranium or radium for example) of a series of transformation products changes so slowly that it remains nearly constant in amount over the period required for the products to attain approximate equilibrium the term *secular* equilibrium is applied. When the primary source, e. g., radium emanation, decays rather rapidly forming shorter lived products, then after a time when equilibrium is established, the amounts of the different products are changing comparatively rapidly depending upon the quantity of parent present. The term *transient* is applied to such equilibrium. Equilibrium may be defined as the state existing when the number of atoms of a radioactive substance produced by the decay of its parent substance equals the number of atoms of the radioactive substance which decay in the same interval of time. A greater concentration than the equilibrium concentration of a radioactive element will not occur normally because the decay constants of the radio-elements are constants. Thus in a ton of uranium (metal) in equilibrium with radium there will be about 333 milligrams of radium (element) and in equilibrium with this radium there is about 0.002 milligrams of radium emanation. In a uranium mineral which is in equilibrium there is produced a radium atom for each uranium atom that transmutes, and in the same time one radium atom disintegrates giving rise to one atom of radium emanation, and likewise at the same time one atom of emanation decays. Under these conditions it is clear that the concentrations of radium and emanation, etc., with respect to the uranium are practically constant. The uranium is disintegrating so very slowly (half decay period 5,000,000,000 years) that its concentration will not vary appreciably in any ordinary period of time and so the equilibrium in an old uranium mineral is an example of secular equilibrium. The equilibrium between radium and radium emanation plus radium A, B and C is nearly attained in 30 days. Since in this time the radium has not sensibly diminished in quantity this again is an example of secular equilibrium. The equilibrium between radium emanation and Ra A, B and C is attained in about four hours. However, in four hours the quantity of emanation has diminished to 97 per cent of the original amount and since nothing like a state of constant activity is attained in such a case, this is an example of transient equilibrium.

ERYTHEMA OR SKIN DOSE. See Dosage.

EXCITED ACTIVITY. Same as active deposit.

FILTERS See Technic.

GAMMA RAYS. Gamma rays are ether vibrations of very short wave length (therefore phenomenon similar to light and X-rays) which are caused by the rapid vibrations set up in electrons in the structure of the transmuting radio element by the electrostatic repulsion between the electron and the escaping high speed beta ray. The gamma rays from Ra B and Ra C are due to beta rays which have initial velocities corresponding to differences in potential of from 500,000 to 2,000,000 volts, and it is likely that the production of X-rays of the same short wave length as the gamma rays from radium will require the use of such high potentials. At present about the maximum voltage used to excite an X-ray tube corresponds to about 100,000 volts (10 inch spark gap). The gamma rays being neither material or electrical, are uninfluenced in a magnetic or electric field, unlike the alpha and beta rays. Recent work using the molecular crystal structure as a space grating has permitted the determination of the wave lengths of the characteristic X rays and of the soft gamma rays. The wave length of the hard gamma rays is too small to be satisfactorily measured by this method. It is estimated that the wave length of the hard gamma rays lies between 0.01 and 0.001 angstrom units (angstrom unit is one ten-millionth of a millimeter) while the X-rays lie in a range between 10 and 0.01 angstrom units, ultra violet light in the range 3300 to 500 A. U., visible light, 7600 to 3300 A. U. and the longer radiant heat waves beyond the red run from 0.06 mm. down to 7600 A. U.; the hertzian or wireless waves running from 3 mm. upwards. All these phenomena are ether waves, but of varying wave length. The total energy carried by the gamma rays from a gram of radium amounts to 6.5 calories per hour.

GLAZED SURFACE PLAQUES. See Applicators.

GRAM. The gram is a unit of weight in the metric system, being 1/1000th of a kilogram. One gram equals 15.43 grains; 28.35 grams equal one ounce av.; 453.59 grams equal one pound av. One metric ton (2204.6 lbs.) equals a million grams or a thousand kilograms.

HELIUM. A rare gas occurring in the atmosphere. It is next to hydrogen, the lightest known element. Its atomic weight is 4, and since it is a monatomic gas whereas the hydrogen molecule is diatomic, helium is only twice as heavy as hydrogen. The helium nucleus is the alpha ray. See Atom, Alpha Ray, and Transformation.

INDUCED ACTIVITY. Older term for active deposit.

IONS. See Conductivity of Gases. The energy required to produce a pair of ions is given as 5.5 x 10^{-11} ergs. The recombination of ions follows the law of mass action, and since ions occur in pairs the rate is proportional to the square of the concentration, provided the gas is free from dust particles. Under certain conditions ions form nuclei for the condensation of water, and this property has enabled C. T. R. Wilson to photograph the trail of ions made along the track of an alpha particle in air supersaturated with water vapor. The number of ions produced by an alpha particle increases rapidly toward the end of its path, e. g., the alpha particle from Ra C products 2250 ions per mm. of path through the first cm. of its range, reaching a maximum of 7600 ions after traversing 6.5 cm. of air at atmospheric pressure and 12° C.

IONIZATION. The ionization produced in a gas by the complete absorption of the radiation is called the total ionization. Natural ionization is the ionization produced by the radioactive products in the air of an electroscope and the deposits on the walls. The normal number of ions in air ranges from 1000 to 2000 per cc.

IONIZATION CHAMBER. The electrode system and containing vessel used in measuring ionization currents produced by radioactive substances.

IONIZATION CURRENT. The current produced between two charged plates by the ions present in the gas between the plates. When the electric field is sufficiently intense to prevent recombination of the ions produced by a radioactive agent the ionization current attains a maximum value called the saturation current.

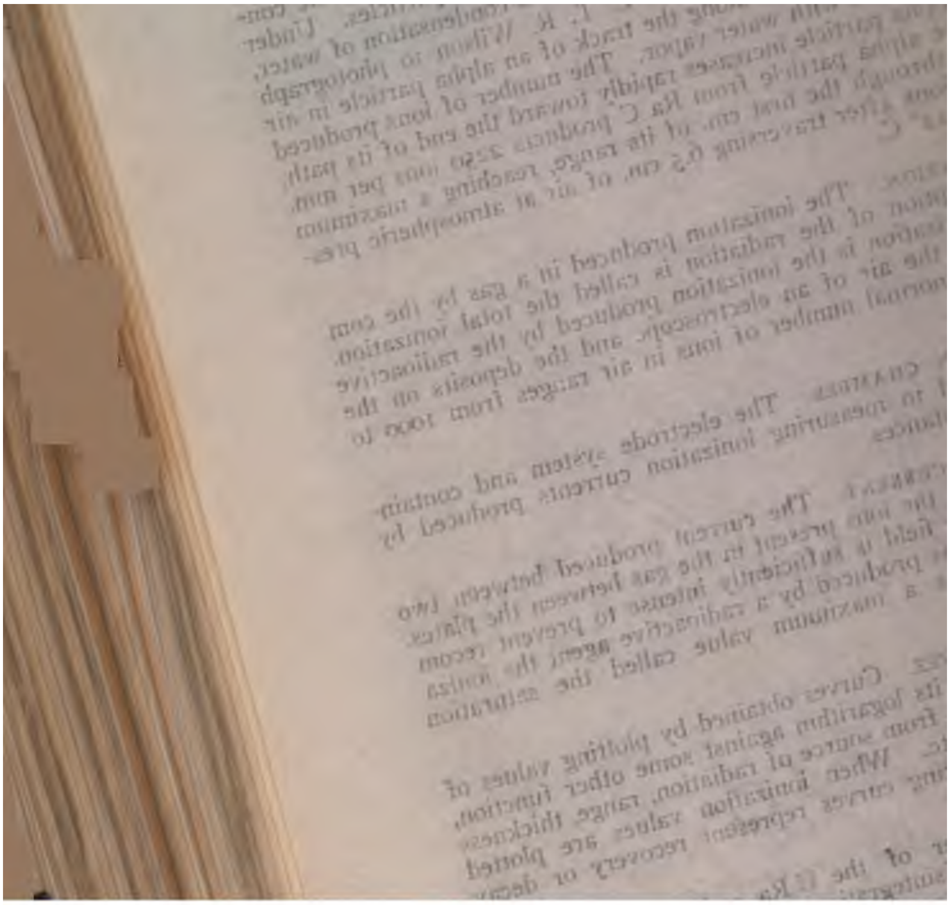
IONIZATION CURVES. Curves obtained by plotting values of ionization current or its logarithm against some other function, such as volts, distance from source of radiation, range, thickness of absorbing layer, etc. When ionization values are plotted against time the resulting curves represent recovery or decay of the active product.

IONIUM. A member of the U Ra series of radioactive elements. Parent U_2; Disintegration product, radium; At. Wt., 230.; half period, at least 100,000 years; range of alpha particle, 3 cm. Inseparable from thorium, its chemical isotope.

ISOTOPES. See Atom.

LEAD, RADIOACTIVE. See Radio lead, Radium D, and Polonium. The activity of lead separated from uranium minerals is due to traces of Ra D, Ra E and Po.

LETHAL DOSE. See Dosage.



LIFE. AVERAGE PERIOD. The period of average life is the sum of the separate periods of future existence of all the individual atoms divided by the number in existence at the starting point. The average life is expressed by I/h, where h is the radioactive decay constant of the substance. See also Period of Half Decay.

MAGNETIC SPECTRUM. See Spectrum.

MESOTHORIUM. MsI: The direct product of Th: very soft beta rays; half period, 6.7 years; isotopic with radium and nonseparable from it. Ms2, the product of MsI; half period. 6.2 hours emits beta and gamma rays. See Table III. Commercially mesothorium is spoken of in terms of milligrams. Actually pure mesothorium has not been prepared, but if prepared would be more than a hundred times more active (gamma rays) than an equal weight of radium. The product of commerce, largely obtained from monazite residues, is usually a mixture of true mesothorium, radium and barium salts. About 20% of the gamma ray activity of newly prepared mesothorium is due to the radium content, the balance being due to mesothorium. The commercial product increases in gamma ray activity for several years, due to the slow products of Th D, and then fall off, until after about 67 years practically only the radium is left. Commercial mesothorium is measured against radium as a standard, using the gamma rays and so a milligram of mesothorium is that amount which has the same gamma ray activity as a milligram of radium. One gram of mesothorium is found in ore containing 19,000,000 grams of thorium or nineteen metric tons of thorium.

MEASUREMENT OF RADIUM. See also Electrometer. The following quotations are parts of a letter to the Editor of the Journal of the American Medical Association written by the Director of the National Bureau of Standards (J. A. M. A., June 19, 1920, p. 173).

"In the routine testing of hermetically sealed radium preparations, the ionization produced in a given ionization chamber by the penetrating gamma radiation proceeding from the preparation is compared with that produced under the same conditions by the similar radiation from a standard containing a known amount of radium. Mesothorium preparations also emit a penetrating gamma radiation, and consequently by a single comparison with the radium standard in the manner just indicated there is no means for distinguishing such a preparation from one containing only radium and its derivatives."

"It is for this reason that the usual radium certificate issued by the National Bureau of Standards contains no statement concerning the actual amount of radium contained in the preparation, but merely a statement of its equivalent radium content.

The primary object of the measurement of such preparations by the bureau is to insure the purchaser against any serious error in the radioactive measurement of the preparation."

"The carnotites, from which the domestic radium is produced, are known to contain only a negligible amount of mesothorium. Tests made on radium produced from such ore gave no evidence of the presence of mesothorium, and were such as to indicate that the mesothorium present cannot exceed 0.2 per cent of the radium content of the material. Consequently, it is quite safe to assume that the radium produced from these deposits will be practically free from mesothorium unless the latter product is deliberately added. This is a matter over which the producer has control and concerning which he can speak with confidence. It is customary for the domestic producers of radium to guarantee that their product is practically free from mesothorium, and such a guarantee might well be requested by the purchaser."

"A check on the possible presence of a signaficant amount of mesothorium in a radium preparation is afforded by its remeasurement. If the preparation contains a *significant* amount of mesothorium, then a second measurement made several months after the first will reveal:"

"1. A growth in the intensity of its radiation if all radiothorium had been removed from the material shortly before the first measurement."

"2. Little or no growth if the radio-thorium was last removed two or three years before."

"3. A decrease of the radiation if the radio-thorium had not been removed for over three years."

"It is evident that unless the two measurements are very specially related to the age of the contained mesothorium, they will reveal its presence."

"In the course of its work, the bureau has to its knowledge remeasured forty-seven radium preparations after intervals varying from two weeks to four years. Preparations from three domestic producers are included in the list. Some of these preparations were resubmitted by their producers, others by the purchasers. For fifteen of the preparations, the interval between these measurements exceeded six months. In no case did the difference between the two measurements exceed the sum of the allowable uncertainties of the two measurements."

"Whence it is seen that as yet we have found no indication that any hermetically sealed preparation offered by a domestic producer as a radium preparation contains an appreciable amount of mesothorium. Very few such specimens offered by small

dealers, jobbers and importers of radioactive material have been submitted to the bureau. Consequently we are at present not prepared to express an opinion concerning the material obtained from such sources."

MICROGRAM. One millionth of a gram.

MILLIGRAM. One thousandth of a gram.

MICROCURIE. One millionth of a curie, q. v.

MILLICURIE. One thousandth of a curie, q. v.

MILLIGRAM HOURS. See Dosage.

MONAZITE. Essentially a phosphate of the cerium group (cerium, lanthanum, didymium) containing a small percentage of thoria (for which the ore is worked to make incandescent gas mantles) and a very small amount of uranium which is the source of the radium in commercial mesothorium.

NEEDLES. See Applicators.

NITON. A name proposed by Sir William Ramsay for radium emanation. Its more general use would obviate the difficulties due to the misuse by many of the term emanations as synonomous with radiations.

NUCLEUS OF ATOM. See Atom.

PERIOD OF HALF DECAY OF RADIO ELEMENTS. (Often called the "period" of a radio element). That interval in which half of any given quantity of a single sort of radioactive atoms disintegrates is called the period of half-life. Since the rate of transmutation of a given radio element is a constant (cf. radioactive constant) the time required for half of any quantity of a given element to transmute is independent of the quantity. So for example if there is a curie of emanation in one vessel and a millicurie in another, after 3.85 days there will remain 0.5 curie in the first vessel and 0.5 millicurie in the second vessel. 3.85 days after that there will be 0.25 curie and 0.25 millicuries respectively in the two vessels. 3.85 days is the period of half life, or briefly, the period of radium emanation. After an interval equal to ten times the period for any given element, it may be shown by calculation that only about 0.1% remains unchanged. Thus (see radium emanation) after 40 days there is left only 0.07% of any quantity of emanation. The period of radium is about 1700 years so that after 17,000 years practically all of a given quantity of radium will have disintegrated. The period of mesothorium I is 6.7 years, and in about 67 years practically all of any quantity of mesothorium I will have decayed. On the other hand, when the period of the parent element is long in comparison with the period of the decay product (setting the equilibrium quantity (q. v.) of the decay

product as unity) may be estimated from its period. For example in a sealed radium preparation initially free from emanation, there accumulates in 3.85 days one-half the equilibrium quantity of emanation. In another 3.85 days there is 75% of the equilibrium amount of emanation and in 10 x 3.85 days there is 0.999 of the equilibrium amount of emanation. If P is the half decay period of a radioactive substance whose decay constant is h, then $P = \frac{0.6931}{h}$ The relation of the average life period, L, and the radioactive decay constant is $L = \frac{1}{h}$ The relation between P and L is $L = 1.443\ P$.

PHOSPHORESCENCE OF RADIO-ELEMENTS. Compounds of radium emit light. This "self luminosity" of radium salts and other radioactive substances is called radioactive phosphorescence. When Sidot's zinc blend, barium platino-cyanide, diamond, kunzite, and some other substances are exposed to the radiations from radioactive substances they become phosphorescent as when exposed to X-rays. See Scintillations.

PHOTOGRAPHLC ACTION OF RAYS. Alpha, beta and gamma rays all affect a photographic plate. Alpha rays affect it only within their range, and since they are stopped completely by thin sheets of paper, the photographic action of radioactive bodies is mainly due to the beta rays. *Since some non-radioactive bodies also affect the photographic plate the photographic method of detecting radioactivity is not a rigorous test.*

PITCHBLENDS. Minerological name, Uraninite. Its principal constituent is uranium oxide, U_3O_8. Its composition is complex: lead, thorium, helium and oxides of the rare earths always occur in it. The uranium content of pitchblende generally ranges between 50 to 80%. The radium content of pitchblende is 3.33×10^{-7} gm. per gm. of uranium. Mme. Curie first isolated radium from the residues of pitchblende.

POLONIUM. (Radium F or Radio-tellurium.) The last active member of the radium series; parent, Ra E; disintegration product, Ra G, isotopic with ordinary lead; At. Wt. 210; half period, 136 days; emits alpha rays only, of range 3.77 cm. Precipitated from solutions by hydrogen sulphide, on a bismuth or copper plate or by electrolysis.

PROTACTINIUM. The decay product from U-Y which is the parent element of actinium. See Actinium Series.

RADIATIONS. See Becquerel Rays; Primary, secondary, penetrating. Alpha, beta and gamma rays constitute the primary radiations, the last named being the penetrating radiation. These radiations are characteristic of the different types of radioactive forms of matter. Secondary rays result when certain types of primary rays impinge upon matter, thus delta

rays are produced as a secondary radiation by alpha rays. Secondary beta rays are produced in matter by the absorption of gamma rays.

RADIOACTIVITY. The property possessed by some of the atoms of high atomic weight of spontaneously emitting a particle or ray from the nucleus of the atom (See Atom.), leaving the remainder to form an atom of a new chemical element. See Transformation and Radioactive Constant.

RADIOACTIVE CONSTANT. Each of the radioactive elements is characterized by a definite rate of decay, and the fraction of the element which decays in a unit of time is said to be the decay constant. For radium the decay constant is 0.0004 per year, for radium emanation, 0.0075 per hour, for Ra A, 0.231 per minute. If I^{o}, equals the initial quantity of a radio element of decay period h, then its quantity I^{t}, at time t (expressed in the same time unit that h is measured in) is given by the relation

$$I^{t}=I^{o}e^{-ht}$$

where e is the base of the natural logarithme. This formula serves to compute the decay and recovery rates of the various radioactive substances, but for practical approximate calculations the period of half decay is more useful (see Period) to one who is not mathematically inclined.

RADIO-CHEMISTRY. That branch of chemistry dealing with the chemical properties of the radio elements. Reference book: Soddy—"The Chemistry of the Radio Elements."

RADIO ELEMENTS. The collective name for the elements possessing radioactivity whose fundamental characteristic is the spontaneous emission of primary radiations, accompanied by the simultaneous appearance of new types of matter.

RADIUM. The prominent member of the uranium radium series of radioactive elements, belonging to the alkaline earth group of elements. Its parent is ionium and its disintegration product radium emanation. Radium was discovered in 1898 by M. and Mme. Curie. The U-Ra series follows;

URANIUM-RADIUM FAMILY

(1) Name	(2) Atomic Weight	(3) Half-Decay Period	
Uranium^1	238	5 billion years	Alpha
Uranium X^1	234	24.6 minutes	Beta
Uranium X^2	234	1.15 minutes	Beta
Uranium^2	234	About 1,000,000 yrs.	Alpha
Ionium	230	About 100,000 yrs.	Alph
Radium	226	1,700 years	Alpha
Radium Emanation (Nition)	222	3.85 days	Alph
Radium A	218	3 minutes	Alph
Radium B	214	26.8 minutes	Beta
Radium C (99.97%) (0.03%)	214	19.5 minutes	Beta
Radium C^2, (Side Reaction 0.03%)	210	1.4 minutes	Beta
End 0.03%	210	....	.....
Radium C' (Main Reaction, 99.97%)	214	0.000001 seconds	Alpha
Radium D	210	16.5 years	Soft
Radium E	210	5.0 days	Soft
Radium F (Polonium)	210	136 days	Alpha
Radium G (End Product)	206	....	No r stal

RADIUM SALTS. (Cf. Activity). The word "r
was used abroad signified a radium salt—and in a s
pure crystalline radium bromide (Ra $Br_2 2H_2O$). Ho
a number of the salts of radium are now used and i
preparations it is most accurate to state the radi
content of the salt. This makes comparisons betwee
ent salts a simple matter, since in most cases the p
salt is of less consequence than its radium elem
The salts most commonly used are the sulphate, b
chloride. These salts as used in the local applic
rays are generally not pure radium salt but a mixtur
and the corresponding barium salt. Preparations c
to 90% of pure radium salt form the greater part of
radium output. The hydrous bromide (Ra Br_2 2H
pure, contains 53.6% of radium element. The pur
radium bromide ($RaBr_2$) contains 58.6 per cent of
ment. The pure sulphate (Ra SO_4) contains 70.
element, and pure radium chloride ($RaCl_2$) cont
radium element. The chloride and bromide are solu
while the sulphate is insoluble in water and in dilute
milligram of radium element is contained in 1.87 r
hydrated bromide, in 1.42 mg. of pure sulphate and
of pure chloride. The radium salts of commerce a
grayish powders which glow more or less brightly i
For details regarding the commercial refining of
Carnotite.

RADIUM EMANATION. The gaseous radioactive product in the uranium-radium series. Its density is 111.2 (hydrogen equals 1); a noble gas, whose nearest analog is xenon. The gas is easily separated from radium solutions by boiling. Cf. "Curie." The identity of the alpha article, after loss of charge, with the helium atom, was first shown by Ramsay and Soddy in the production of helium in spectroscopic quantity from radium emanation. The disintegration products of the emanation constitute the active deposit of radium, q. v. Its solubility coefficient in water at 20° is 0.30. The Boltwood standard of radioactivity is based upon the quantitative determination of radium emanation by electroscopic methods, and the fact that radium and uranium occur in minerals in radioactive equilibrium.

TABLE OF DECAY AND GROWTH OF RADIUM EMANATION

A — fraction of emanation remaining after time t.
B — fraction of equilibrium amount of emanation formed in t days in a radium preparation initially free from emanation.

Time	A	B	Time	A	B
0	1.000	.0000	8 days	.2369	.7631
1 hr.	.9925	.0075	9 days	.1979	.8021
2 hrs.	.9851	.0149	10 days	.1653	.8347
3 hrs.	.9777	.0223	11 days	.1381	.8619
4 hrs.	.9704	.0296	12 days	.1153	8847
5 hrs.	.9632	.0368	13 days	.0963	.9037
6 hrs.	.9560	.0440	14 days	.0805	.9195
7 hrs.	.9489	.0511	15 days	.0672	.9328
8 hrs.	.9418	.0582	16 days	.0561	.9439
9 hrs.	.9347	.0653	17 days	.0469	.9531
10 hrs.	.9277	.0723	18 days	.0392	.9608
11 hrs.	.9208	.0792	19 days	.0327	.9673
12 hrs.	.9139	.0861	20 days	.0273	.9727
13 hrs.	.9071	.0929	21 days	.0228	.9772
14 hrs.	.9003	.0997	22 days	.0191	.9809
15 hrs.	.8936	.1064	23 days	.0159	.9841
16 hrs.	.8869	.1131	24 days	.0133	.9867
17 hrs.	.8803	.1197	25 days	.0111	.9889
18 hrs.	.8737	.1263	26 days	(2)928	.9907
19 hrs.	.8672	.1328	27 days	(2)775	.9923
20 hrs.	.8607	.1393	28 days	(2)647	.9935
21 hrs.	.8543	.1457	29 days	(2)541	.9946
22 hrs.	.8479	.1521	30 days	(2)452	.9950
23 hrs.	.8416	.1584	40 days	(3)747	.9993
1 day	.8353	.1647	50 days	(3)123	.9999
2 days	.6977	.3023	60 days	(4)204	.....
3 days	.5827	.4173	70 days	(5)337	.....
4 days	.4868	.5132	80 days	(6)558	.....
5 days	.4066	.5934	90 days	(7)922	.....
6 days	.3396	.6604	100 days	(7)152	.....
7 days	.2837	.7163	....	......	.....

The numbers in parenthesis, e. g., (6) refer to the number of O's before the first significant figure. From *Rutherford's* "Radioactive Substances and Their Radiations," page 665.

RADIUM EMANATION APPARATUS for Preparing Applicators. The most practical method for this is the one devised by Debierne and Duane (See Methods of Preparing and

Using Radioactive Substances in the Treatment of Malignant Disease, and of Estimating Suitable Dosages, by Dr. William Duane, Boston Medical and Surgical Journal. 787-799, December 6, 1917). For a more detailed description of a practical form of this apparatus as used in a number of hospitals in this country, see the Description of an Apparatus for the Collection, Purification and Tubing of Radium Emanation from a Radium Solution by C. H. Viol, Radium, XIV, 1-9, October, 1919.

RADIUM THERAPEUTICS. Use of radium or radium emanation or other radioactive substances for therapeutic effect. See Technic.

RADIOTHORIUM. The radio atom resulting from the transformation of mesothorium 2 with emission of a beta ray. Radiothorium has a half decay period of 1.9 years, and the atom transforms by loss of an alpha ray leaving an atom of thorium X.

RANGE. The range of alpha particles is the distance in air at 760 mm. and 15° C over which the alpha particle will produce ions. See Absorption.

REACTION. See Technic.

RECOIL ATOMS. When an alpha particle is shot off from an atom with high velocity the remainder of the atom recoils with a velocity inversely proportional to its mass. The larger atom which thus recoils is called the "recoil atom," or "rest-atom."

RECOMBINATION OF IONS. See Ions.

ROENTGEN RAYS, OR XRAYS. Radiations set up when a cathode ray beam is suddenly stopped by striking a solid object. The rays are highly penetrating, affect a photographic plate, and are very similar to gamma rays, q. v. They have the power of ionizing air but this ionization is due to secondary beta rays set up by the X-rays.

SAGNAC RAYS. Same as secondary rays, see under Technic.

SATURATION CURRENT. See Ionization Current.

SECONDARY RAYS. See under Technic.

SCINTILLATIONS. The phosphorescence produced by alpha rays upon a screen of zinc sulphide when examined through a low power microscope is seen to consist of numerous instantaneous flashes of light called scintillations. When two alpha particles are emitted almost simultaneously, as is the case when a very short-lived alpha ray product occurs in a series, the flashes appear on the screen in pairs, and are termed double scintillations.

SCINTILLASCOPE OR SPINTHARISCOPE. An instrument devised by Crookes for making visible the scintillations from a speck of radium. Cf. Scintillations.

SCREENS. See Technic.

SIDOT'S BLEND. A special form of phosphorescent zinc sulphide is known as Sidot's hexagonal blend.

SPECTGUM, MAGNETIC. The beta radiation from the radio elements is generally not homogeneous, and may be separated by the magnetic field into several sets of rays. Thus, Ra B emits several groups whose velocities in terms of light are respectively, .36, .41, .63, .70, .74.

STANDARDS. See Electrometer and Measurement of Radium. The International Radium Standard is a specimen of pure radium chloride prepared by Mme. Curie and kept at The International Bureau of Weights and Measures at Sevres near Paris. Secondary or prototype standards are kept in Vienna. The great confusion consequent to the discrepancies which were found to exist between the so-called radium standards of the various workers in radioactivity, led the Congress of Radiology and Electricity, which met in Brussels in 1910, to appoint a committee to make arrangements for the preparation of the International Radium Standard. 21.99 milligrams of pure anhydrous radium chloride prepared by Mme. Curie, were sealed in a glass tube, and this preparation, containing 16.75 milligrams of radium element, was accepted by the Committee as the International Radium Standard. Preparations of pure radium chloride, purified by Hoenigschmidt at the Radium Institute of Vienna Academy of Sciences, for atomic weight work, were compared by the Committee with Mme. Curie's preparation and found to agree within a limit of 1 part in three hundred. These three Vienna preparations contained 10.11, 31.17 and 40.43 milligrams of anhydrous radium chloride.

Due to its high activity, it is not convenient to work with even a hundredth part of a milligram of pure radium salt in an ordinary electroscope, and quantities of radium of from 0.01 milligram up to a gram are best compared by means of the gamma rays. When a radium salt has been kept sealed for a month, the maximum amount of emanation and active deposit has accumulated and the gamma ray activity reaches a marimum. Under these conditions, it is possible to determine the quality of radium in a preparation using an electrometer which must have a case made of lead, at least a centimeter thick (to absorb beta rays). The radium preparation is placed near the charged electrometer and the rate of discharge is observed. This discharge is due to the gamma rays, which pass through the lead

case and ionize the air inside of the electrometer. The preparation is removed to a great distance, or put in a thick lead box and a standardized preparation (i. e., one which contains a known amount of radium) is placed in the *same position,* near the electrometer and its gamma ray ionization current observed. The rates of discharge of the instrument are proportional to the quantities of radium contained in the preparations, so that the unknown quantity of radium can easily be calculated. Other standards that have been used are: (1) Boltwood Standard, the emanation in equilibrium with a known weight of pure radium salt, or uranium mineral of known radium or uranium content; (2) McCoy Standard, the total amount of activity from 1 gram of uranium element as oxide in the form of a film of maximum constant activity; (3) Mache unit (m. u.) is a term to express concentration of radium emanation. It is defined as the saturation ionization current due to the radium emanation (free from decay products) from a liter of solution or gas, expressed in electrostatic units multiplied by 1000. One microcurie is equal to 2700 mache units.

TECHNIC. The physiological effect of the rays from the radioactive substances are attributable to the "photo-electric" effect, that is the liberation in the structure of the tissue cells of negative electrons. In the case of the primary beta rays, which are negative electrons, their absorption in tissue suffices to start the effect. Gamma rays produce their effect by the action of the secondary beta rays which they set up on absorption in matter. The ready absorption of the primary beta rays limits their use to the treatment by unscreened radium applicators in superficial growths which do not exceed several millimeters thickness. The gamma rays, by reason of their greater penetrating power, produce secondary beta rays through considerable thickness of tissue and hence are useful in the treatment of deep lesions. When employing the primary beta rays, the action of the gamma rays is negligible, whereas when the gamma rays are employed it is usually necessary to filter out the beta rays with suitable metal screens and so avoid the production of undesirable superficial reactions. The metal filters commonly employed are silver (1.0), brass (1.3), steel (1.4), lead (1.0), gold (0.6), platinum 0.5), and aluminum (4.0) and the thickness in millimeters of these substances necessary to absorb 99.9% of tre hard beta rays from radium is given by the numbers in parenthesis. (See Absorption). The most useful screens are those of silver and brass. Secondary beta rays (so called rayons de Sagnac of the Roentgenologists) are emitted from the surface of metal screens due to the absorption of gamma rays and these secondary rays are usually absorbed in several layers of paper, rubber or gauze (1 to 3 mm.) (See Distance effects further on.) When beta rays are being employed from a surface plaque having dimensions greater than those of the area to be rayed, a window screen of 1 mm. thick sheet lead can be used. In the window screen of

the dimensions of the plaque, is cut an opening of the dimensions of the area to be rayed, and after laying a few thicknesses of paper, rubber, etc., on the skin, the window screen is applied and over it is attached the surface applicator.

In the local application of radium, for therapeutic effect, it is necessary to irradiate all of the pathological tissue with a sufficient dose and at the same time it is desirable to avoid producing severe reactions in adjacent normal tissues. This result is best attained by the device of cross-fire, the use of distributed radium preparations. For superficial dermatological conditions covering a considerable area, the surface plaques are the best means of obtaining homogeneous radiation, while for the nodular or more extensive thick growths the use of a group of tubes or needles on the surface of the neoplasm or inserted into it, constitutes the best method. With the gamma rays absorption in the tissues is an almost negligible factor in the reduction of their intensity and limitation of their range of action compared with the effect of divergence of the rays. From a small or point source the intensity of the radiation diminishes inversely as the square of the distance from the source of rays. So from a small radium tube, if the intensity of radiation at 1 mm. is set as unity at 2 mm. the intensity is 0.25; at 3 mm., 0.11; at 4 mm., 0.06; at 10 mm., 0.01; at 2 cm., 0.0025 and at 3 cm. 0.0011. It is obvious from this why the physiological effect of the gamma rays is limited to distances of 2 to 3 cm. in the treatment of malignant growths, where the dose necessary to produce destruction of the neoplasm in some cases is one which will almost produce a similar destructive action on adjacent normal tissues. A few millimeters distance between the radium tube and an adjacent normal skin surface is often of considerable importance, and it is to provide this distance (as well as to absorb the secondary beta rays emergent from the metal container) that fairly thick layers of such non-metallic substances as paper, gauze, sheet rubber or tubing are placed over th emetal filters.

The ray dose required in the treatment of various conditions depends on so many factors that at present no simple rules can be laid down, and it is in this respect that experience in radium therapy is of the highest importance in obtaining the best results. With a given amount of radium even, dosage as often expressed by the product of the milligrams of radium used and the hours of application—so-called milligram hours—is of no particular significance unless there is also stated the actual quantity of radium used, the metallic screens, the distance between the radium and growth, and the time intervals if any, between applications. It is obvious, for example, that a 10 mg. tube preparation laid on the surface of a growth can only have at the most one-half its rays passing into the growth, and so, is only one-half as effective as a similar amount of radium inserted in the form of a needle into the mass of a growth. It

Memoranda

TOILE. See Applicators.

TRANSFORMATION. The theory of successive transformation or atomic disintegration of Rutherford and Soddy assumes that the atom of the radio-elements, at some time in its life history suddenly disrupts and ejects a charged particle with high velocity, leaving a new atom possessing very different chemical properties. The alpha particles emitted in this process are positively charged helium nuclei, and the rest atom i sa new element with an atomic mass of four units smaller. This fundamental process in the radio-elements follows a simple exponential law:

$$N/No=e^{-ht}$$

derived from the law of mass action, that the rate of change at any time is directly proportional to the quantity present. N^{o} is the number of atoms present initially, N, the number present at time t, and h, a constant characteristic of the species of atoms, and known as the radioactive decay constant, q. v. When equilibrium is attained the number of atoms of each product decaying is compensated by the number produced, the amounts of each product being inversely proportioned to its radioactive constant. Unlike the constant of monomolecular chemical changes, the value of the radioactive decay constant is independent of the temperature, chemical constitution, and any other factors that influence the speed of chemical changes.

URANIUM. The first member of the uranium-radium series. Its principal sources are pitchblende and carnotite. A member of the iron group. For its estimation and separation, see Brearley, "The Analytical Chemistry of Uranium." See Table of Elements in Uranium-Radium Family under Radium.

URANIUM X. The product responsible for the photographic action of uranium compounds, and first separated from uranium by chemical methods by Crookes. Now called UX_1. See U-Ra Series.

URANIUM Y. A branch product formed by the decay of about 3% of U_2. U-Y upon decay produces protactinium, the parent of actinium.

URANINITE. Pitchblende.

VARNISH APPLICATORS. See Applicators.

VELOCITY. The velocity of the alpha rays varies between 9,000 and 15,000 miles per second. The velocity of the alpha particle from Ra C is 2.06 x 10^9 cm. per second. The range of the particle depends upon the velocity. The initial velocity of beta particles varies and in some cases approaches that of light, e. g., the velocity of the beta rays from Ra C ranges from 0.78 to 0.957 that of light. The gamma rays have the velocity of light.

WINDOW SCREEN. See Technic.

WILLEMITE. A lemon yellow to white colored native silicate of zinc, mined at Franklin Furnace, N. J. Specimens of this mineral often phosphoresce brightly under the alpha, beta and gamma rays of radium and a piece of willemite serves well in a dark room to localize position of radium in wrapped-up packages, or to indicate roughly whether distributed radium is giving off fairly uniform intensity of rays.

X-RAYS.. See Roentgen Rays.

ZINC SULPHIDE. Radioactive Phosphorescent. (Sidot's hexagonal blend.) When mixed with a small proportion of radium, 10 to 150 parts per million, the alpha ray scintillations produce a luminescence which persists even when the preparation is kept in the dark. This is the so-called radium luminous compound.

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